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1919-21

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of

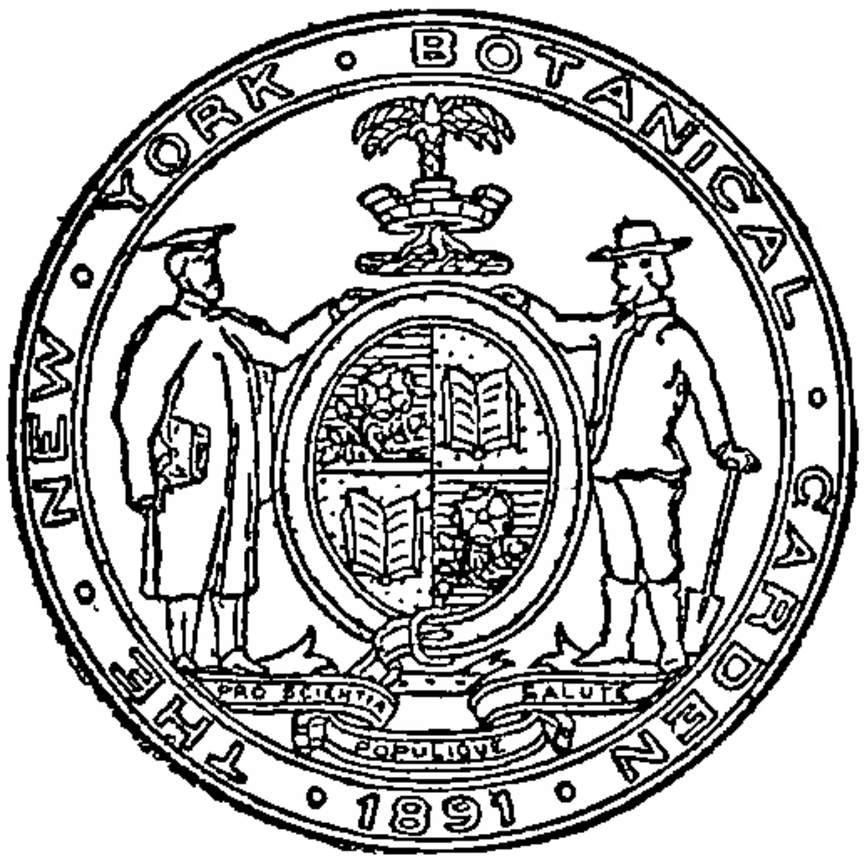
The New York Botanical Garden

Volume X, 1919–1921

BULLETIN

OF

The New York Botanical Garden



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1919-1921

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BULLETIN
OF
The New York Botanical Garden

Vol. 10 No. 37

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1918

(*Accepted and ordered printed, January 13, 1919*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit my report as Secretary and Director-in-Chief for the year ending January 13, 1919.

Notwithstanding conditions brought about by the participation of our country in the necessary task of checking the Teutonic attempt to dominate civilization, the work of this institution has proceeded without serious limitations. Our collections of plants, of specimens, and of books have all been increased; educational work has been continued as during previous years, with a smaller number of special and advanced students than usual but with quite as much attention to the needs of the general public. All the plantations formerly established were maintained, variously modified by additions or substitutions; a comprehensive dahlia collection, brought together and installed by Curator Marshall A. Howe, formed a new plantation of exceptional interest and beauty. Through continued cooperation with the Horticultural Society of New York, the collection of roses was increased by many kinds, and the rose garden was full of flowers from early spring until late autumn. The collections in the herbaceous garden, placed in charge of Dr. E. B. Southwick, have been

largely increased by him; valuable gifts of palms were received from Mrs. C. P. Huntington, from Mrs. Finley J. Shepard and from Mr. Percy Chubb, and many other tropical plants from other donors; the great cactus collection has been increased by rare species from Ecuador, collected by Dr. J. N. Rose. New horticultural plantations were installed south of the herbaceous garden, on the land used last year for the convention garden of the Society of American Florists and Ornamental Horticulturists, including extensive series of gladioli, cannas, rose mallows, and hardy chrysanthemums, and the path system here has been extended by several hundred lineal feet. Some additions have been made to the collections of trees forming the arboretum, and about 600 lineal feet of additional paths have been partially constructed there, through the plantation of magnolias.

The total number of kinds of living plants now represented in out-of-door plantations and under glass is approximately 14,524, as against about 14,195 in cultivation during 1917. We now have more kinds in cultivation than in any previous year.

Additions to the library aggregate 703 bound volumes, this large collection of books now numbering 29,237 bound volumes. Museums and herbaria have been increased by about 24,127 specimens; through continued effort by Dr. Rusby, the collections forming the economic museum have been increased, largely rearranged, and mostly catalogued; the publication of this catalogue will be a noteworthy contribution to economics.

Work has been in progress during the whole year on the construction of the new greenhouses at conservatory range 2, through the munificent gifts of $50,000 each for this purpose in 1917 by Messrs. Daniel Guggenheim and Murry Guggenheim; the contractors have been much delayed by conditions beyond their control; it is now expected that these structures will be completed in the spring. Through the same gifts and the accumulated interest

upon them, an additional coal bunker was built at power house 2, and an additional steam boiler required for heating the new greenhouses has been there installed.

The beautiful school garden shelter house, given by Mrs. Frederick Ferris Thompson by her contribution of $4,000 for this purpose in 1917, was completed during the summer, after much delay in obtaining roofing tiles; path approaches to this building, aggregating over 1,000 lineal feet, were built by an unexpended balance of this gift and much necessary grading was accomplished in the immediate vicinity.

Cooperation with the International Children's School Farm League, providing instruction in gardening, was continued in the spring, until Mr. Henry G. Parsons, Supervisor of Gardening Instruction, was called to the United States Government Service in May. The school garden has been maintained during the remainder of the year and is available for use next spring. Acting upon authority granted by the Board of Managers, President Thompson has offered the Federal Board of Vocational Training cooperation in the vocational training of convalescent soldiers and sailors in practical gardening, and this offer is under consideration.

Botanical exploration was carried on in Florida by Dr. John K. Small, under the highly appreciated patronage of Mr. Charles Deering; in Colombia by Dr. Francis W. Pennell, in cooperation with Dr. Rusby's expedition for the investigation of medicinal plants; and in Ecuador by by Dr. J. N. Rose, of the Smithsonian Institution, who was aided by a grant from our Science and Education Fund. A very important cooperative arrangement for the investigation of the flora and plant products of northern South America was entered into with the Gray Herbarium of Harvard University and the United States National Museum; collections from that region will greatly enrich our greenhouses, museums, and herbaria.

Public lectures were delivered by members of the staff

and by others on every Saturday afternoon from April 6 to November 2. Docents, selected from members of the staff, for the instruction of parties from schools and of other visitors, have been available every week-day afternoon throughout the year, and their work has been highly appreciated. The laboratories have been available for advanced students, but war conditions have prevented any considerable number applying for instruction. The library has been much consulted by students and visiting investigators. As in previous years, a great amount of information has been given out by mail and to visitors, all members of the staff participating in this informational duty.

Publications during 1918 include No. 36 of the *Bulletin*, completing Volume 9; *Journal* Volume 19; *Mycologia* Volume 10; 3 parts of *North American Flora;* 6 numbers of *Contributions;* and the third volume of *Addisonia.*

Additions to permanent funds have been small, but bequests, not yet paid, have been announced of $5,000 from the estate of Louisa Combe, of an appraised valuation of $3,897 from the estate of Emil Wolff, and of a munificent gift by the late Mrs. Russell Sage, being one fifty-second part of her residuary estate.

Plants and Planting

Planting in many parts of the grounds was accomplished, both in the spring and in the autumn, continued, owing to the mild weather of December, until quite the end of the year; a detailed account of the work done will be found in the report of the Head Gardener herewith submitted.

1. *Herbaceous Gardens*

Much attention was given to collecting native plants in the vicinity of New York, and adding them to the representation of many families of plants. A much larger number of annuals were grown from seeds obtained from various sources than in former years. The general group-

ing of the plots was unchanged, but some of them were enlarged. The defective water supply in the northern end of the valley, referred to in my last annual report, has not yet been repaired and needs attention.

2. *Fruticetum*

Additions were made to the shrub collection by specimen plants hitherto grown in the nurseries. The extremely cold weather of January damaged some of the plants which had withstood winter conditions for ten years or more, notably the Japanese holly (*Ilex crenata*) and nearly all the varieties of box; during the season, however, these have largely recovered.

3. *Salicetum*

The willow collection in the north meadows has not been modified. The path leading through it on the west side of the river was resurfaced with fine ashes from the power house, as well as the paths through the north meadows on the eastern side of the river, a total length of path of about 4,000 feet being thus resurfaced. We find this surface construction of paths with ashes economical, both as to material, which costs nothing, and as regards maintenance, because weeds are much less abundant than in paths surfaced with blue-stone screenings.

4. *Deciduous Arboretum*

The list of hardy woody plants in the collections, compiled by Mr. George V. Nash, Head Gardener, and published in successive numbers of our *Journal* during the past year, is of great interest; it proved to be more extensive than was at first contemplated and it is not yet completely printed, but should be finished by the spring. The severe winter weather left its traces on a number of trees, almost the entire series of Japanese cherries having had their flowers blighted so that their blooming was insignificant. The collection of catalpas, purchased by means of a gift

by Mrs. Florence Lydig Sturgis, is developing satisfactorily at the northeastern corner of the reservation. Some additional species were added to the collection by trees brought from the nurseries. Some work was accomplished on the extension of the path system, which is as yet incomplete.

5. *Pinetum*

The collection of coniferous trees has not been much modified and but few additions have been made to it. Many of the trees planted in previous years have now developed into perfect and elegant specimens. The series of yews is especially noteworthy, and it is planned to extend this plantation somewhat in the spring. The severe weather of January killed three fine trees of the Deodar cedar (*Cedrus Deodara*), which had withstood winters for fifteen years and had attained a height of about 18 feet; the Japanese cedars (*Cryptomeria*) were damaged by the frost, but have essentially recovered.

6. *Viticetum*

The vines and climbers on the arbor east of the economic garden were pruned in the spring, but the collection otherwise unchanged. It was found necessary to cut out a few contiguous trees which were shading some of the vines.

7. *Water Gardens*

No additional kinds of aquatics were added during the year. The hardy water lilies continued as a feature of beauty and interest throughout their flowering season. The large masses of cat-tails (*Typha*) which have developed here from very small beginnings, may now require some restriction of their progressive occupation of the borders of the pond.

Both the hardy and the tender water lilies and their relatives, grown in the two concrete tanks in the court of conservatory range 1, continued flowering freely. The leak in the tank containing the tender kinds, mentioned

in my last report as having given trouble, was corrected, by coating the entire bottom of the tank with a thick coat of tar.

8. *Iris Garden*

The collection of irises at the southwestern corner of the reservation was completely replanted in the spring, the plants having grown so vigorously as to make this necessary; the number of kinds was not increased nor the area of plantation extended, although space is available for much additional planting. A path leading from the iris garden along the west side of the driveway eastwardly to the mallow garden, called for in the general plan, is now much needed.

9. *White Pine Plantation*

The young white pine forest, established in the spring of 1916 on the rocky hill north of the iris garden, in cooperation with the State Conservation Commission through the interest of Dr. Walter B. James and the Honorable George D. Pratt, has continued to develop satisfactorily, and is of great interest as a demonstration of forest establishment. It has been carefully protected from fire by keeping the grass cut short in the autumn, and each young pine has been mulched with a small amount of leaf mould.

10. *Red Pine Plantation*

Through the further interest of the State Conservation Commission and of Dr. James, a new plantation of the red pine (*Pinus resinosa*) was made in the spring on the rocky ridge opposite Fordham Hospital, nearly 2,000 four-year-old transplants being furnished us by the Commission at a nominal cost. It so happened that planting conditions in the spring were so good that nearly every little pine grew, and this plantation has also been of exceptional interest. When these trees grow up, their healing balsamic fragrance will doubtless reach patients in the hospital.

11. *Horticultural Gardens*

The land prepared last year for the convention garden of the Society of American Florists and Ornamental Horticulturists, south of the herbaceous garden, was occupied in the spring by special horticultural plantations as suggested in my last annual report, consisting of extensive series of gladioli, cannas, phloxes, hardy chrysanthemums, and rose mallows, which were highly enjoyed during their flowering periods. They were completely labeled and an important educational element was thus added. A commencement was made in establishing evergreen backgrounds for these plantations, but much of this desirable planting remains to be done, and a path is much needed from the southern end of the herbaceous garden to the collection of mallows.

12. *Lilac and Peony Garden*

The collection of lilacs brought together near Pelham Parkway, south of the rose garden, has not been increased during the year, but the plants have been cultivated. It is proposed in the spring to move into this collection about one half of the series of Lemoine hybrid lilacs at present in the plantation near the museum building, given some years ago by Mr. T. A. Havemeyer. The planting of the peony collection here must await the necessary path construction and grading of the area concerned. Meanwhile, we are bringing together collections of peonies in other plantations, which will be available for this garden at the proper time.

13. *Rose Garden*

The grading of the bank at the eastern side of the stone stairway given by Mrs. Robert E. Westcott was completed early in the spring and the new bank sodded. Sufficient stone was obtained here to build the northern boundary path at the same time. The high-level path overlooking the rose garden from the west has not yet been completed;

when finished, it will afford a very beautiful view of the plantation and its woodland background. Large additional collections of roses were added, both in the spring and in the fall, through continued cooperation with the Horticultural Society of New York, and space has been reserved within the garden for kinds not yet obtained.

No further progress has been made in the architectural features planned for the rose garden. These have been referred to the Endowment Committee for consideration. The plantation was guarded as during the previous season, by having one gardener come on at daylight and another gardener stay until evening; under this observation, no serious depredations have been suffered.

14. *School Garden*

Through continued cooperation with the International Children's School Farm League during the spring, the school garden was used by students until May, at which time Mr. Henry G. Parsons, Supervisor of Gardening Instruction, was called to Government Service in the Department of Conservation; a typical vegetable home garden was maintained there during the remainder of the season. The completion of the school garden shelter house, with its tool cellar, during the summer, has provided a most attractive and useful feature, contributed by Mrs. Frederick Ferris Thompson, whose gift of $4,000 for this purpose enabled us not only to construct the building but to build all the path approaches to it and to do considerable necessary grading.

15. *Mansion Garden*

It will be recalled that plans for a formal garden to be located just south of the mansion were approved in 1916. The completion of other work in progress and the need of available funds for other purposes have thus far prevented us from building this garden.

16. *Flower Gardens*

The extensive plantations of garden flowers around conservatory range 1 and extending to the elevated railway station, have been variously modified by additions and substitutions, and have been kept labeled. The difficulty in obtaining fresh supplies of bulbs and the high expense of such as could be obtained have operated to reduce the number of bulbous plants cultivated in these gardens during the previous season; this restriction will probably be continued during the coming year.

17. *Dahlia Garden*

As outlined in my last annual report, the mixed flower garden which has been maintained for a number of years in front of the border screen between the railroad station and the Mosholu Parkway entrance was replaced this year by a large and comprehensive collection of dahlias, brought together by Dr. Marshall A. Howe, one of our curators, who has long given attention to the botany and cultivation of these plants. Over 300 kinds were brought into the collection through contributions of roots by many friends, and the plants flowered profusely, and owing to the mild autumn the period of blooming was extended well into November.

It is proposed to modify the front of the border screen south of the railroad station extending to the Bedford Park Boulevard entrance, by installing there during the coming season a comprehensive series of hardy chrysanthemums, and preparations have been made to carry this suggestion into effect.

18. *Nurseries and Experimental Grounds*

Collections in the nurseries were considerably reduced during the year by the transferral of plants to other situations, and the area under cultivation here is thus somewhat smaller than in the previous year. The Director of the

Laboratories has continued experimental work in plant breeding, which is described in his report hereto appended.

19. *Conservatory Range 1*

The collections in this great greenhouse have been conserved and considerable additions have been made to them, the fine series of palms presented by Mrs. Collis P. Huntington and Mrs. Finley J. Shepard being the most noteworthy. The houses are densely crowded at the present time, owing to the transferral, made necessary by the coal situation, of the collections from conservatory range 2 in the early part of 1918, and this crowding of plants is not conducive to the best cultivation or the most effective exhibition. A considerable rearrangement of the collections has also been found necessary, so that the account of the contents of the different houses as published in our last guide-book is now out of date in a number of details. Very extensive repairs to the roofs of these greenhouses were found necessary during the year, requiring a large expenditure of money for re-glazing and re-framing, and the heating system required a large amount of new steam pipe; all these repairs were accomplished by our own mechanics and steam engineers.

20. *Conservatory Range 2*

This range of greenhouses has been empty during the entire year, as a consequence of the coal situation. Opportunity has been taken to completely repaint both the interior and exterior and to make light necessary repairs to the frame. Construction of the two additional greenhouses of this range, made possible by the gifts of $50,000 each by Messrs. Daniel Guggenheim and Murry Guggenheim, elsewhere described in this report, will presumably be completed in the spring, and it is proposed, during the summer, to put this range in operation again and to replace within it the collections moved to conservatory range 1; many additional plants for this collection may be brought

from various points in tropical America at such time as this becomes practicable.

21. *Propagating and Experimental Greenhouses*

In order to conserve fuel, two of the four greenhouses of this range were emptied in the autumn, partly by the elimination of duplicates and partly by transferrals to conservatory range 1. One of the two houses in operation contains parts of our extensive collection of cactuses, most of which, when conservatory range 2 is in operation, it is planned to move to conservatory range 1. Only ordinary repairs have been required for these buildings.

22. *Natural Features*

The natural beauty of the reservation remains unimpaired. Some dead and decrepit trees have been cut out of the woodlands and used for fuel and fencing, and this work is in progress at the present time. As a whole, however, the trees are in excellent condition and the amount of dead wood within the reservation is very small. Our patrol against fire and vandalism has been effective, but it is only that which has preserved the woodlands from serious damage, inasmuch as a considerable number of fires have been started, either accidentally or maliciously. It is still desirable to extend the railings along trails in various parts of the woodlands, in order to restrict travel to well-defined lines, but the cost of iron during the past year has made this extension impossible to secure, and wooden railings have been found altogether unsatisfactory, being subject to rapid decay and requiring high expenditure for repairs.

The income of the fund for the preservation of native plants, given some years ago by the Misses Caroline and Olivia E. Phelps-Stokes, has been allowed to accumulate. It is proposed to use this accumulation, added to the income of the fund for 1919, for the reproduction of additional colored illustrations of wild plants requiring special protection.

23. *Border Screens*

The screen of trees planted some years ago along the northeastern boundary of the reservation, adjoining land which was brought into the Bronx River Parkway, was much thinned during the early part of the year by the cutting out of many trees, as recommended in my last annual report, and the landscape of the valley in this region has been much improved by this elimination. There remain a few more trees which may better be removed. The border screen on the western margin of the reservation, along the New York Central and Hudson River Railroad, may also be thinned to advantage in a few places.

Museums

The general arrangement of the museum collections has not been changed, the series of specimens illustrating economic botany remaining on the first floor of the museum building, the collection of fossil plants on the basement floor, the systematic collections on the second floor, and the herbarium and special collections on the third floor; all have been materially increased by additional specimens and somewhat modified by substitutions.

1. *Economic Museum*

Acting on previous authorization, Dr. H. H. Rusby, Honorary Curator of the Economic Collections, commenced a revision and cataloguing of this great series of vegetable raw products in the spring, and has since continued this work during all the time at his command, with the help of Mr. R. S. Williams, Administrative Assistant, and Mr. Percy Wilson, Associate Curator. Several hundred valuable specimens hitherto held in storage have been incorporated into the series as the work, which is now more than half completed, has proceeded; the catalogue, which includes notes and descriptive matter, has been typewritten in great part and thus prepared for publication in our *Bulletin;* it is anticipated that this catalogue may be made

ready for printing in the spring. Details of this work will be found in Dr. Rusby's report hereto appended. The newly incorporated specimens require mounting and labeling.

2. *Systematic Museum*

Some additions have been made to these collections on the second floor of the museum building. It is hoped that through further exploration of regions botanically little known, many specimens of fruits, seeds and other plant products may be obtained for further illustration of the families of plants.

It has now become desirable to transfer some of the collections on the third floor of the museum to the second floor, in order to relieve the crowding of specimens, and it is proposed to put the plan in operation which was approved by the Scientific Directors several years ago, by bringing the entire collections of fungi from the third floor to the second, where they would be installed in the western wing. About 30 additional museum and herbarium cases will be required to effect this transferral satisfactorily.

3. *Paleobotanical Museum*

The report of the Honorary Curator of the Collection of Fossil Plants hereto appended refers to work accomplished on this collection, and notes progress made in the study of the fossil plants obtained from Porto Rico and from Cuba, these yielding the first knowledge which has been obtained concerning the ancestors of living plants of the West Indies; discoveries made in Cuba during the past year by Brother Leon, of the College of La Salle in Havana, have opened up a field which will certainly yield material of great scientific value as types of undescribed species, and it is highly desirable that the localities found to yield fossil plants by him and by his associates should be thoroughly explored.

4. *Herbarium*

The report of the Head Curator of the Museums and Herbarium gives details of work upon these immensely valuable collections, which have been largely increased and extensively rearranged and classified during the past year. Twelve new herbarium cases were obtained and put in position, and these have made it possible to incorporate many thousand specimens which have been held in storage for several years, including about 4,800 brought from Colombia by Drs. Rusby and Pennell. Much material is still held in storage which should be brought into the collections in order to make it available for the use of students, and it is hoped that additional cases may be obtained.

5. *Lantern Slides, Photographic Negatives, and Prints*

Much progress has been made in the rearrangement and cataloguing of lantern slides and negatives since the appointment in 1917 of Miss Elsie M. Kittredge as an Assistant Curator, referred to this duty, and some additions have been made to these collections, for which an additional case is now required.

The large collection of prints and other illustrations of plants stored in cases in the library is being rearranged and made more satisfactory for consultation through the work of Mrs. Mortimer J. Fox, a member of the Garden, who kindly offered to serve as a voluntary assistant in the autumn and has since continued as such; her services are highly appreciated.

Library

During the year, considerable additional shelving space, long required for books, was attained by boxing a large part of the private library of Dr. John H. Barnhart, Bibliographer, which has been deposited with the Garden for several years. The portions boxed were duplicates of volumes in the Garden's library. Dr. Barnhart's collection contains a large number of desirable books which are

not represented in the library otherwise, and he has consented to sell these to the Garden as funds may become available from time to time. A commencement of such purchases was made this year by the expenditure of $400 from the income of the William R. Sands Fund, appropriated for books. The rearrangement above described necessitated moving from case to case the entire Garden library of nearly 30,000 volumes, which was accomplished by the janitors.

The library has become one of the most important collections of the literature of plants in existence, but a large number of rare works published prior to 1850 are still unrepresented in the collection. It appears probable that the close of the world war in Europe will throw many libraries upon the market, and probably no such opportunity to obtain rare books will ever again occur. It would therefore be highly desirable to have considerable freedom of expenditure for the purchase of books during the coming year, and several thousand dollars could be used to advantage. This brings up again the desirability of obtaining a fund specified for library purposes, to yield an annual income of $2,000 or more.

Reference is made to the reports of the Bibliographer and the Librarian hereto appended.

Public Instruction and Information

Continued attention has been given to requests for information by visitors, and the system of docentry established some years ago has been most useful. Most members of the staff have acted as docents on occasion, but the regular assignment to this duty for afternoons at three o'clock has been divided between Mr. Percy Wilson, Associate Curator, Mr. R. S. Williams, Administrative Assistant, and Mr. H. W. Becker, Foreman Gardener. Subsequent to public Saturday afternoon lectures, the lecturer has frequently escorted as many of the audience as desired to go, to points in the grounds and buildings

where collections further illustrated the topic discussed, and these trips have been highly appreciated by visitors. The labeling of all collections has been continued and expanded, and all inquiries for information received by mail have been answered as promptly and as completely as possible.

In order to still further develop the usefulness of the collections in public instruction, it is proposed to concentrate the supervision of the direct educational work of the institution in a member of the staff, under the designation of Supervisor of Public Instruction.

Exploration

The very important botanical exploration of the Republic of Colombia by Drs. Rusby and Pennell, referred to in my last annual report, was satisfactorily completed in the spring, at which time Dr. Pennell returned with very large collections of specimens and many living plants. Many seeds obtained from this trip have been germinated in the propagating houses, and interesting species have thus been added to the collection of tropical plants. The herbarium and museum specimens obtained have been classified in a preliminary way and their study will add greatly to knowledge of the flora of northern South America; duplicates will soon be distributed to other institutions in continuation of exchanges.

The proposed cooperative arrangement with the Gray Herbarium of Harvard University and with the Smithsonian Institution, referred to in my last report, was consummated early in the year, and the first expedition under this arrangement was conducted during the summer and autumn in Ecuador by Dr. J. N. Rose, of the United States National Museum; the expenses of this trip were met by funds provided by the United States Department of Agriculture, aided by a contribution from the income of our Science and Education Fund and by a contribution from the Gray Herbarium. Dr. Rose returned late in

the year with a large and important collection, including living plants of the cacti of Ecuador which were previously very imperfectly known; these collections are now being arranged for study at Washington, and a duplicate set of them will come to us in due time.

The study of the plants of southern Florida undertaken by Dr. John K. Small, Head Curator, some years ago and continued as opportunity has permitted, has been very important in determining the existence in the United States of many plants otherwise known only from the West Indies or tropical continental America, and has also demonstrated the occurrence there of a number of endemic species. Inasmuch as the region is fast being developed for residential and agricultural purposes and its natural features thus modified or destroyed, the investigation was most timely. The work has been greatly aided through the valued cooperation of Mr. Charles Deering, who has established gardens on his estate at Miami for the further preservation of the rarer plants.

In continuance of our investigations of the West Indian flora, collections have been received from Brother Leon of Havana and Brother Hioram of Guantanamo, Cuba, from Mr. William Harris in Jamaica, and from Mr. L. J. K. Brace in New Providence, Bahamas.

Roads and Paths

The maintenance of the driveways by the Park Department, as provided by the Garden's Charter, has been excellent and the system is in good condition; the valued cooperation in this work, as also in other matters, by the Hon. Joseph P. Hennessy, Commissioner of Parks of the Borough of The Bronx, and of members of his staff, is highly appreciated.

Little progress was made in completing the large embankment needed on the line of the unfinished driveway at the north end of the long lake, where some earth has been needed to finish the slopes; the practical cessation of build-

ing operations in the vicinity of the Garden, due to war conditions, prevented us from obtaining the filling needed from contractors having surplus earth to dispose of, but it is hoped that this material will be forthcoming during the next season. In reply to an inquiry by the Commissioner of Parks in May, relative to requirements for corporate stock during the next four years, the request was made for an issue of $5,000 for the completion of this driveway, which would finish the construction of the driveway system of the reservation as planned.

Some work has been done toward completing the driveway approach to the central display greenhouse at conservatory range 2 from the Bronx Boulevard and is in progress there at the present time, looking to the completion of this road in the early spring.

All the constructed paths, and the trails through the woodlands, have been kept in order by our own employees, requiring only the hoeing out of weeds and the resurfacing of paths of the system by ashes from the power house. Additional paths, 10 feet in width, aggregating a total length of 1,685 feet, have been constructed in various parts of the grounds, and several hundred feet of others have been partially built, as recorded in the report of the Superintendent of Buildings and Grounds hereto appended.

All the bridges have been carefully inspected and are in good order.

Grading and Drainage

Contingent upon the building of additional paths, considerable grading and filling was required; earth used in filling was obtained from the excavation made for an additional coal bunker at power house 2, as also considerable stone used in path building. At conservatory range 2, a large knoll of rock along the Bronx Boulevard was drilled and blasted and the rock used for building walls of the new greenhouses and of the new coal bunker, and also in roads and paths, sufficient being reserved to construct the walls of a new coal bunker at power house 1. The removal of

this knoll was necessary for landscape considerations in preparing the ground for the proposed new flower garden at conservatory range 2. It proved to contain building stone of a very high quality.

Some stone for path foundations was also excavated in the rocky hill just north of the museum building, where the surface remains unfinished.

Additional drainage was accomplished along the driveway at the mallow garden by laying over 200 feet of 4-inch and 3-inch pipes, and a swampy area was thus reclaimed. Additional data may be found in the report of the Superintendent of Buildings and Grounds hereto appended.

Water Supply

The water pipes have not been extended during the season, but an extension is now necessary, owing to the decrease in pressure during the past several years in the supply of the mansion. A new connection seeking to improve this pressure was made a few years ago, and for a time appeared satisfactory, although the pressure did not reach much above the second floor. What is apparently needed is to purchase and lay about 600 feet of 4-inch water-main from near the school garden to the rose garden, along the south side of the uncompleted driveway, and connect this with pipes already laid reaching to the mansion. I have elsewhere referred to the defective water supply of the northern end of the herbaceous garden, which should be made good, and a water pipe is needed through the school garden.

Buildings

Extensive repairs were found necessary on the museum building, on the roof of conservatory range 1, and on the boilers in power house 1, requiring high expenditure for materials. A considerable portion of this work was made necessary by the arctic temperatures of the early part of the year, which caused a maximum amount of contraction in structures and the subsequent loosening; also the neces-

sity of forcing boilers to their full capacity for long periods of time deteriorated boiler tubes and furnaces to a marked degree. The repairs were all made, and the buildings are now in good condition. Details are recorded in the report of the Superintendent of Buildings and Grounds.

The two additional greenhouses at conservatory range 2 under construction, through the generosity of Messrs. Daniel Guggenheim and Murry Guggenheim, will presumably be completed and made ready for operation in the spring, and they will provide long needed space for the exhibition of tropical and subtropical plants. The larger of these two structures, designated the Central Display Greenhouse, has been designed, at the suggestion of President Thompson, to include an open space which may be utilized as a lecture hall, and the facilities thus provided will doubtless prove a very important pedagogic addition to our equipment. This large greenhouse may also serve for more or less permanent horticultural exhibition, the need for which has always been realized in the city.

The construction of the additional coal bunker at power house 2 provides important additional storage for coal. It is hoped that we shall succeed in enlarging the coal storage capacity at power house 1 during the coming season, as already planned and authorized. Increased coal storage capacity will operate economically in reducing the expense of handling coal, and also operate to obtain coal at somewhat lower prices. In order to ensure a coal supply for the present winter, an amount estimated as sufficient to last until April was purchased, after consultation with the Commissioner of Parks, and delivered at power house 1 during the summer and autumn. It was purchased from Olin J. Stephens, payment to be made for the amount consumed in 1918 from appropriations for that year, and the remainder from appropriation for 1919.

Liberty Bonds

As authorized by the Board of Managers, employees of the Garden were given the privilege of subscribing to both

the third and fourth issues of Liberty Bonds, payable by instalments. The Treasurer purchased $3,800 of the third loan and $8,800 of the fourth loan for this purpose. A list of employees subscribing to either the third or the fourth issue, or to both, is as follows:

G. K. Ackerman, Jr., Clerk
C. J. Auld, Gardener
J. H. Barnhart, Bibliographer
H. W. Becker, Foreman Gardener
Mary T. Becker
J. Blaess, Laborer
J. Brennan, Steam Engineer
N. L. Britton, Director-in-Chief
B. Cassell, Gardener
T. Chadwick, Gardener
Walter Charles, Janitor
A. J. Corbett, Superintendent of Buildings and Grounds
J. A. Curry, Laborer
W. Curry, Driver
G. De Genova, Gardener
James Dwyer, Stableman
William Eagen, Gardener
J. Fagan, Carpenter
Anna Farley
J. Farley, Laborer
F. Finen, Fireman
James Finley, Gardener
John Finley, Foreman Gardener
G. Frick, Laborer
George Friedhof, Gardener
Henry Friedman, Clerk
A. Glass, Gardener
A. Gleasel, Gardener
W. S. Groesbeck, Bookkeeper
J. Hagenauer, Night Watchman
Morris Hannon, Night Watchman

Sarah H. Harlow, Librarian
John Hartling, Head Gardener's Assistant
J. J. Hoffstadt, Mason
M. A. Howe, Curator
P. Howe, Mason
W. Hutchinson, Fireman
Owen Keefe, Gardener
Elsie M. Kittredge, Assistant Curator
R. McAvis, Driver
W. J. McGreevy, Head Steam Engineer
R. McLaughlin, Gardener
J. Malley, Driver
J. Masterson, Night Watchman
E. J. Meyer, Laborer
J. W. Millard, Janitor
J. Moore, Gardener
G. Morse, Night Watchman
W. A. Murrill, Assistant Director
G. V. Nash, Head Gardener
John Purcell, Gardener
Jacob Radlein, Gardener
M. A. Rice, Night Watchman
P. A. Rydberg, Curator
T. Scanlon, Keeper
Grace M. Schilling
F. A. Schilling, Museum Custodian
F. Schmidt, Janitor
F. J. Seaver, Curator
Harry Shafer, Fireman
J. K. Small, Head Curator
C. Smith, Gardener
Harvey Smith, Janitor
J. W. Smith, Gardener
John Sommer, Gardener
E. B. Southwick, Custodian of Herbaceous Grounds
D. E. Stilwell, Janitor
T. Stokes, Keeper

A. B. Stout, Director of the Laboratories
D. B. Strickland, Steam Engineer
F. A. Thumann, Carpenter
P. Vogel, Laborer
T. Webb, Laborer
F. White, Laborer
Florence M. Willey, Stenographer
R. A. Willey, Driver
R. S. Williams, Administrative Assistant
R. E. Wills, Steam Engineer
Percy Wilson, Associate Curator
Wild Flower Preservation Society

Reports Appended

Following this report will be found those of the Assistant Director, the Head Gardener, the Head Curator of the Museums and Herbarium, the Librarian, the Bibliographer, the Director of the Laboratories, the Superintendent of Buildings and Grounds, the Honorary Curator of the Economic Collections, the Honorary Curator of the Collection of Fossil Plants, and the Honorary Curator of Mosses; also a list of subscriptions to the Emergency Fund subscribed by members during 1918, and a schedule of expenditures by the Bookkeeper.

Respectfully submitted,

N. L. Britton,
Director-in-Chief.

REPORT OF THE ASSISTANT DIRECTOR

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1918.

The growing season of 1918 was quite moist until late summer and especially favorable for herbaceous plants and evergreens. Many of the latter, however, were severely injured by the unusually cold winter, as described

by Mr. Nash in the *Journal* for March and July. The autumn was very fine, and the dahlias were not killed until November sixth.

Supervision of the work on the control of destructive insects has been continued by Dr. Seaver. It was thought that the unusually severe winter might affect the viability of the tussock moth, but experiments showed this hope to have been unfounded. Large numbers of the egg-masses were gathered in the spring and destroyed. The destructive work of the tussock moth was not excessive on our grounds, due in part at least to artificial control.

The Japanese cherries have suffered considerable damage from the West Indian peach scale (*Aulacaspis pentagona*). Special attention is being given to this insect with the hope of clearing out the pest. Aphids were exceedingly numerous during the season but their natural enemy, the lady-bird, was also very abundant and helped to reduce the destructive work of these insects. The rose beetle and other standard pests continued their work and have been combatted as formerly. Work on the control of rose mildew and other destructive fungi has also been continued as usual.

Lectures

Public Lectures

Illustrated public lectures on botanical and horticultural subjects have been given in the museum building on Saturday afternoons from April to November, as outlined below. The total attendance for the year has been 2,454, averaging 79 for each of the 31 lectures; the maximum attendance being 136 on September 21.

April 6. "How to Prepare the Soil for Gardening," by Mr. J. G. Curtis.

April 13. "Vacant Lot Gardens," by Mr. Carl Bannwart.

April 20. "Tree-planting for Forests," by Professor S. W. Allen.

April 27. "Home Gardens," by Mr. Henry G. Parsons.

May 4. "Drug Plants and Their Cultivation," by Dr. H. H. Rusby.

May 11. "How to Grow Fruits in Limited Areas," by Professor M. A. Blake.

(Exhibition of Flowers, May 11 and 12)

May 18. "Fiber Plants and Their Cultivation," by Mr. Lyster H. Dewey.

May 25. "Women as Gardeners," by Miss Delia W. Marble.

June 1. "Diseases of Garden Crops and Their Control," by Dr. Mel. T. Cook.

June 8. "Insect Pests and Their Control," by Dr. F. J. Seaver.

June 15. "Rose Gardens," with visit to new Rose Garden, by Mr. G. V. Nash.

(Exhibition of Roses and Peonies, June 15 and 16)

June 22. "Economic Uses and Possibilities of the Seaweeds," by Dr. M. A. Howe.

June 29. "Wild Flowers of Summer," by Dr. N. L. Britton.

July 6. "Scenic and Botanic Features of the Dells of the Wisconsin River," by Dr. A. B. Stout.

July 13. "How the Introduction of Foreign Plant Diseases is Prevented," by Mr. H. B. Shaw.

July 20. "The Economic Uses of the Fungi," by Dr. F. J. Seaver.

July 27. "Edible Wild Plants of the Vicinity of New York," by Dr. H. H. Rusby.

August 3. "Rock and Alpine Gardens," by Dr. E. B. Southwick.

August 10. "The Sphagnum Moss and its Use in Surgical Dressings," by Dr. G. E. Nichols.

August 17. "Through the Eastern Andes of Colombia," by Dr. F. W. Pennell.

August 24. "Ancient and Modern Ideas in Regard to Fossil Plants," by Dr. Arthur Hollick.

(Exhibition of Gladioli, August 24 and 25)

August 31. "Autumn Flowers," by Dr. N. L. Britton.
September 7. "Gladioli," by Professor A. C. Beal.
September 14. "Evergreens," by Mr. G. V. Nash.
September 21. "Dahlias," by Dr. M. A. Howe.
(Exhibition of Dahlias, September 21 and 22)
September 28. "Flora of the Vicinity of New York," by Mr. Norman Taylor.
October 5. "Autumn Coloration," by Dr. A. B. Stout.
October 12. "Cut Flowers and How to Use Them," by Mr. E. I. Farrington.
October 19. "The Value of Birds in a Garden," by Dr. G. Clyde Fisher.
October 26. "Some Plant Diseases of New York and Virginia," by Dr. E. W. Olive.
November 2. "Plants as Insect Traps," by Dr. J. H. Barnhart.

Publications

Journal

The *Journal* has been published for each month during the year, making a volume of 340 pages, with 16 plates.

Mycologia

This periodical has appeared on alternate months during the year, making a volume of 307 pages, with 14 plates.

North American Flora

Volume 21, part 3, containing descriptions of Alliniaceae, by P. C. Standley, appeared January 22, 1918.
Volume 32, part 1, containing descriptions of Rubiaceae, by P. C. Standley, appeared December 28, 1918.
Volume 22, part 6, containing descriptions of Rosaceae, by P. A. Rydberg, appeared December 30, 1918.

Bulletin

Bulletin No. 36, with 115 pages, was issued April 30, 1918. It contains the annual reports of the Director-in-Chief and other officers for the year 1917.

Addisonia

The third volume of this publication, containing 84 pages of popular descriptions and 40 colored plates, appeared in four parts, issued in March, June, September, and December.

Contributions

No. 203. The Flora of the American Virgin Islands, by N. L. Britton.

No. 204. Further Notes on the Structural Dimorphism of Sexual and Tetrasporic Plants in the genus Galaxaura, by M. A. Howe.

No. 206. Revision of the North American Species of Encalypta, by Dorothy Coker.

No. 207. Notes on Plants of the Northern United States—IV, by Francis W. Pennell.

Docentry

Over 2,360 visitors, including classes from public and private schools, have availed themselves during the year of the privilege of viewing the buildings and grounds under the guidance of Mr. P. Wilson, Mr. R. S. Williams, and Mr. H. W. Becker.

Nature Study

On January 22, about 240 biology pupils from Evander Childs High School, accompanied by Mr. Paul B. Mann and several other biology teachers, came to the Garden to study the conservatory collections and attend an illustrated lecture on Forestry by Mr. George E. Hewitt.

On February 27, 500 biology pupils from the Evander Childs High School, accompanied by Mr. Mann, Mr. Hewitt, and several other teachers, attended a lecture in the museum by Mr. Henry G. Parsons on "How to Make and Care for a Home Garden."

On April 17, 176 students from the Evander Childs High School attended a lecture by Mrs. Britton on the preservation of our native plants under the auspices of the Caroline and Olivia Phelps-Stokes Fund.

The tenth anniversary meeting of the School Garden Association of New York, was held at the New York Botanical Garden on the afternoon of June 8, with a large number of members in attendance. Addresses were delivered in the Mansion lecture room by Dr. N. L. Britton, Mr. Van Evrie Kilpatrick, and Mrs. Henry Parsons.

On June 18, 452 students from the Morris High School visited the large conservatory range and portions of the grounds, and then attended a lecture in the museum building.

On June 19, 247 students from the Evander Childs High School visited the large conservatory range and portions of the grounds, and then attended a lecture in the museum building.

Scientific Meetings

The monthly conferences of members of the staff and students have been continued, and a report of each meeting has been published in the current number of the *Journal*.

The Torrey Botanical Club has met each month as usual in the morphological laboratory in the museum building. On October 30, the public hall was used in connection with the regular meeting of the Torrey Club for an illustrated lecture by Dr. E. O. Hovey on certain botanical explorations of the "Macmillan Expedition."

The Police of the Fifty-third Precinct, under Captain John Ievers, pursuant to the request of the Police Commissioner, used the museum lecture hall one evening a week during July and August, for the organization and instruction of the Women's Police Reserve and the Emergency Relief Organization of the Police Department. The average attendance at the seven lectures was 66.

The New York Microscopical Society held a field meeting at the Garden on the afternoon of June 8, for the study and collection of pond life; most of the time was spent at lakes 2 and 3, where many minute treasures were found, both animal and vegetable.

The Horticultural Society of New York, in cooperation

with the New York Botanical Garden, held exhibitions of plants and flowers in the museum building on May 11 and 12, June 15 and 16, August 24 and 25, and September 21 and 22.

A lecture on the use of plants and flowers in design was given at the Mansion on October 17 by Miss Donlevy.

Personal Investigations

Administrative, curatorial, and editorial duties have left little time for consecutive scientific work this year. The demand for information has increased, especially in connection with fungi causing forest diseases and fungi used for food.

The gill-fungi of tropical North America were completed and the two final instalments published in *Mycologia* for January and March. Several parts of *North American Flora* are in preparation, with the assistance of other specialists.

The popular illustrated articles on fungi in *Mycologia* have been continued with the aid of colored plates drawn by Miss Eaton, six species of polypores and ten species of gill-fungi having been treated in this series during the year.

Respectfully submitted,

W. A. Murrill,
Assistant Director.

REPORT OF THE HEAD GARDENER

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1918.

Systematic Plantations

Herbaceous Grounds. There have been grown in these collections during the past year about 3,266 species and varieties; there are here 130 beds, 26 east of the brook and 104 west. 289 show labels have been made for this

collection. Mr. E. B. Southwick has had charge of the work here, as well as in the Economic Garden and Morphologic Garden adjoining.

FRUTICETUM. The representation now here includes 52 families, 141 genera, and 1,035 species and varieties; the number of specimens is 2,960.

SALICETUM. There are 159 specimens here, representing 2 genera, 39 species and varieties.

DECIDUOUS ARBORETUM. Including those native to the tract and still at the nurseries, there are in this collection 411 species and varieties, 59 genera and 31 families. There are 1,120 trees.

PINETUM. Here there are about 1,669 specimens, representing 3 families, 20 genera, and 267 species and varieties. 130 show labels have been placed here.

VITICETUM. Here there are about 50 species and varieties.

CONSERVATORIES. The collections here comprise about 9,356 species and varieties, representing 207 families. Owing to the shortage of coal it was necessary about the middle of last January to combine the contents of range 2 with those of range 1. This made necessary dispensing with many duplicates and cutting down the representation to as few individuals as possible, so that the collections in both ranges could be placed in one. Even after this had been done, range 1 was still greatly crowded, a condition not the best for the growing of plants. There are now in range 1, 13,447 specimens, distributed as follows: house 1, 361; house 2, 793; house 3, 879; house 4, 762; house 5, 1,616; house 6, 360; house 7, 850; house 8, 678; house 9, 143; house 10, 1,005; house 11, 466; house 12, 1,050; house 13, 668; house 14, 1,066; house 15, 2,735; cellar, 15. 1,240 show labels have been placed here.

PROPAGATING HOUSES AND NURSERIES. For the purpose of economizing in coal it was decided to close two of the houses for this winter. This necessitated sending many plants to range 1 and dispensing with all duplicates possible. There are now here, excluding those used for

the special studies of the Director of the Laboratories, 6,506 plants. 1,040 packets of seeds have been received, as follows: gift, 137; purchase, 365; exchange, 210; collected, 328. There have been collected in the grounds, in addition to the above, 120 packets.

LABELING, RECORDING AND HERBARIUM. This work has been under the direction of a gardener for the first four months of the year, and later of the head gardener's assistant. One apprentice has been employed for ten months of the year in the preparation of labels, of which the following have been made: pinetum, 130; fruticetum, 593; conservatories, 1,240; conservatory beds, 285; herbaceous grounds, 289; economic garden, 52; morphologic garden, 23; rose garden, 136; iris garden, 18; school garden, 4; horticultural collections, 333; dahlia collection, 516; total, 3,619.

Accession numbers 45,908 to 47,073 have been recorded, making a total of 1,166 accessions.

The following plants have been received: by gift, 20,543 (including the large collections of gladioli and dahlias), valued at about $7,800; by exchange 184; by purchase, 1,394; by collections made by members of the staff and others, 639; derived from seeds from various sources, 358; total, 23,118.

To the herbarium of cultivated plants about 200 specimens have been added.

The collections contain approximately, including those native to the tract, 239 families, 2,108 genera, and about 14,524 species and varieties.

Miscellaneous Collections

Included here are the following: morphologic garden; economic garden; collections of desert plants placed during the summer in the court of conservatory range 1; conservatory lily pools; aquatic garden; rhododendron collections in the vicinity of the lakes, at conservatory range 1, and in front of the museum; rose bed east of conservatory range

1; flower gardens in the immediate vicinity of conservatory range 1, at the Elevated approach, and the west border; American wood garden; iris garden; magnolia garden; American thorn garden; white pine plantation; lilac and peony garden.

Rose Garden. This continues to be one of the most attractive collections of horticultural plants. Many interested people visit it. There are now 104 beds, in which have been grown during the past year about 5,200 rose bushes and 500 kinds.

Horticultural Garden. The area in which the convention garden was located in 1917 has now been devoted to a series of horticultural collections. This installation was begun with a collection of gladioli, planted in May, of 19,700 corms, all donated by some of the largest growers. This collection contained, in 17 beds, 247 kinds, one of the largest collections ever brought together in the vicinity of New York.

The two long beds at the entrance contained cannas, about a dozen kinds being represented. There were also two beds of chrysanthemums and one of phlox. In the large central bed was a collection of cacti, and between the entrance and the cannas was arranged a group of agaves on each side.

Dahlia Collection. This collection was installed at the west border north of the depot plaza. It was assembled by Dr. M. A. Howe, of the staff, through donations amounting to 516 plants, representing 313 kinds. It was one of the most attractive features of the Garden during the fall, being visited by many people.

Red Pine Plantation. Opposite the white pine plantation, already established, was installed a plantation of the Norway or red pine. To the north of this was placed a group of the Japanese red pine, *Pinus Thunbergii.*

General Horticultural Operations

The following force has been available for this work; monthly, 2 foreman gardeners, 18 to 22 gardeners, and 5 drivers; laborers, 18 to 22.

Foreman gardener John Finley has been in charge of the outside work, with about eight gardeners, the drivers, and laborers.

The work of the conservatories and propagating houses has been in charge of foreman gardener H. W. Becker, to whom was assigned the remainder of the force.

The following new work has been accomplished during the year:

In the Spring

The development of the horticultural garden on the site of the former convention garden. 17 beds were planted with nearly 20,000 corms of gladioli, 2 with chrysanthemums, 1 with phloxes, and 2 with cannas. A collection of marsh mallows was begun in the low land on the east side. The mallows exhibited the previous year by Meehan & Sons and by Bobbink & Atkins were donated to the garden by those firms, and form a part of this collection, together with a large number of plants, of hybrid origin mainly, produced by Dr. A. B. Stout, of the staff, in his experiments with the genus *Hibiscus*. The opening of 10 additional beds in the rose garden. The planting of conifers around the school garden shelter house. The preparation of a strip about 12 feet wide at the west border from the depot plaza north, for the reception of the collection of dahlias, and the planting of the same. Additions to the magnolia garden. The transplanting of specimens from the nurseries to the deciduous arboretum and the fruticetum. The replacement with others of the conifers killed during the previous winter. The rearrangement of the path corners near the fountain enclosure, a group of *Picea Omorika* being placed on one side and one of *Picea polita* on the other. The planting of a large number of seedlings in the conservatory beds.

In the Fall

The removal of the Japanese holly about the fountain at the foot of the Museum approach, greatly damaged

during the previous winter, and its replacement with conifers. The rearrangement of the shrub and tree border back of the dahlia collection, and the addition to it of more shrubs. The planting of replacements in the rose garden, and the rearrangement of some of the beds there. The planting of three white ash trees near the depot plaza to replace others removed. The planting of a red oak and a red maple along the main drive south of the Museum. The planting of a red maple along the drive west of the upper lake. The planting of about 8,000 tulip bulbs in some of the beds in the court of conservatory range 1.

Investigations and Lectures

I have continued my studies in horticultural botany, especially upon the hardy woody collections of the Garden, and also upon the orchids.

I have acted with Dr. Barnhart as one of the editors of *Addisonia*, and have continued my supervision of the preparation of drawings for that periodical. I have given three lectures in the regular public courses of the Garden.

Mr. K. R. Boynton, Head Gardener's Assistant, had charge of the conservatory beds and their collections, and gave valuable aid in the installation of the gladiolus collection. He performed his duties up to the time of his induction in the service of his country in May. Mr. John Hartling has been acting in that capacity since that time.

Respectfully submitted,

GEORGE V. NASH,
Head Gardener.

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit herewith my report as Head Curator of the Museums and Herbarium for the year 1918.

Miscellaneous specimens were brought together from nearly all parts of the globe. However, the more impor-

tant ones came from the western hemisphere and from the islands of southeastern Asia.

The accessions were recorded during the year in detail in the several numbers of the *Journal*. They may be summarized here as follows:

By gift and purchase	3,462
By exchange	10,499
By exploration	10,166

Thus a total of 24,127 specimens for public museums and the herbarium, and for exchange purposes were received during the year. About 2000 specimens were sent to other institutions and to individuals as exchanges.

The several collections falling under my supervision were developed and conserved mainly as in previous years.

The permanent equipment was increased by the acquisition of twelve standard herbarium cases.

The value of gifts is estimated at $197.71.

Museums

The public exhibits were given especial attention during the year in the way of developing and completing various collections or exhibits.

The Fossil Plant Museum was enlarged by specimens from Greenland and the West Indies. The exhibits were kept in order and several of the cases renovated and relabeled. For further details see the report of the Honorary Curator of fossil plants.

The Economic Museum was the center of active development during the year. A systematic renovation and enlargement of the exhibits was begun and is in process of execution. The exhibits are being made more complete by the addition and replacement of specimens and all arranged in a more logical order and sequence.

Aside from the miscellaneous specimens received for the various exhibits, the most important additions were special specimens of fibers, foods, and drugs secured by Dr. Rusby. For details see the report of the Honorary Curator of the Economic Collections.

The Systematic Museum, comprising four distinct elements, (*a*) The Synoptic Collection, (*b*) The Local Flora, (*c*) The Microscope Exhibit, and (*d*) The Plant Picture Exhibit, was either added to in parts or partly renovated.

Herbaria

The more important additions to these collections were specimens representing the floras of continental and insular North America and northern South America. In addition to miscellaneous specimens and odd collections, special sets of fungi were received from the West Indies and several parts of the United States, lichens from Yukon, Montana, and the West Indies, hepatics comprising part of the former herbarium of M. A. Howe, mosses from the Philippine Islands, the West Indies, and various parts of the United States, and especially noteworthy very valuable collections of flowering plants from Colombia and the Philippines and neighboring islands.

Collections of less importance were received from other regions such as Argentina and Africa.

A considerable number of specimens, particularly of the rarer and more interesting species of the region of Greater New York were brought together and added to the local flora herbarium. In this connection the material aid in collecting, aside from members of the Garden Staff, may be mentioned Mr. W. E. Ferguson. The geographical origin of all the accessions is given in detail in the several numbers of the *Journal.*

Individual specimens and small collections received for the Columbia University herbarium were mounted and incorporated in that series.

In all, about 13,793 herbarium sheets containing fully 29,000 specimens of flowering and flowerless plants were added to the permanent collection. In addition to these several hundred specimens too bulky to be mounted on herbarium sheets were placed in cardboard boxes and incorporated in the several series where they belonged.

The twelve new herbarium cases referred to above have been used to take up the expansion necessary to relieve the congested condition of the herbarium and the space thus gained will accommodate a part of the miscellaneous accumulation of mounted herbarium specimens formerly held in storage. Certain space freed through the rearrangement of part of the general herbarium has given opportunity to expand and rearrange the local herbarium and the herbarium of cultivated plants.

The great number of unmounted herbarium specimens, accumulated as a result of lack of herbarium cases and assistants to mount them are being sorted into the natural plant families and genera so that any specimen there represented will be available for study in connection with the various lines of research being carried on by members of the Garden Staff. A great deal of very valuable and useful material would otherwise be inaccessible.

Investigations and Assistance

The curatorial work of the museum and herbarium has been cared for by the several curators and associate curators, some of whom have also participated in or cared for various side issues and all of whom have followed, incidentally, some line or lines of investigation.

Dr. P. A. Rydberg, Curator, continued in charge of the herbarium of flowering plants. In addition to the usual assorting and distribution of herbarium sheets, the task of assorting a large accumulation of herbarium material, transferring part of the general herbarium into the new cases, and readjusting the whole herbarium to the increased space as well as arranging the unmounted herbarium specimens fell to Dr. Rydberg's lot. He also continued his taxonomic investigations and interpretations of the families Rosaceae, Fabaceae and Carduaceae for *North American Flora.* A monograph of *Rosa* is now in press. The tribe Psoraleae of the Fabaceae is ready for the press, and the manuscript of the tribe Senecioneae of the Carduaceae is

nearly finished. Dr. Rydberg has also reprinted the analytical keys of his "Flora of the Rocky Mountains and Adjacent Plains" to make an easily portable book for field work.

Dr. Marshall A. Howe, Curator, continued in charge of the collections of algae and hepaticae in the herbarium and museums. He has prepared a manuscript on the Ricciaceae for the *North American Flora* and has published papers on "The Marine Algae and Marine Spermatophytes of the Tomas Barrera Expedition to Cuba," "Further Notes on the Structural Dimorphism of Sexual and Tetrasporic Plants in the genus *Galaxaura*," and "Calcareous Algae from Murray Island (Australia) and Cocos-Keeling Islands." He has also edited vol. XVII of the *Memoirs of the Torrey Botanical Club*, comprising the "Proceedings of the Semi-centennial Anniversary of the Torrey Botanical Club." As a side issue, Dr. Howe had charge of the new dahlia border, described in the issues of the *Journal* for August and November.

Dr. Fred J. Seaver, Curator, continued in charge of the fungous collections. Research on the cup-fungi of North America for *North American Flora* was continued. Progress also has been made with the genus *Phyllosticta* (leaf spot diseases) of which about three hundred species have been described from North America. Some time has also been devoted to a study of the Bahama fungi. Two students have carried on investigation at the Garden under his supervision. A number of minor papers have been published during the year and two lectures have been delivered. Work on destructive insects has been continued (see report of Assistant Director).

Mr. Percy Wilson, Associate Curator, continued his determinations and studies of tropical American plants, and incorporated most of the recently acquired West Indian and South American specimens in the herbarium. During the summer months he devoted considerable time to the classification and rearrangement of exhibits in the

Economic Museum. His duties as docent were carried out as in former years, and incidentally he took charge of many of the Saturday afternoon public lectures.

Dr. Francis W. Pennell, Associate Curator, returned in April from a botanical expedition to Colombia, and on May 1 resumed his active connection with the Garden. The collections made in Colombia, comprising nearly 4,800 numbers, have been sorted and one set mounted for study, while the remainder are being prepared for distribution to other institutions. Beside work upon these he continued studies in the figwort family as represented in the southeastern and in the central Rocky Mountain states and also in the local flora. In June Dr. Pennell resumed editorial supervision of the *Journal*. He gave one lecture in the regular Garden lecture course.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, developed the Museum of Economic botany. (See his report.)

Mrs. N. L. Britton, Honorary Curator of Mosses, developed the moss herbarium. (See her report.)

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, developed the fossil plant museum. (See his report.)

The writer, in addition to numerous major and minor curatorial details, continued work on *North American Flora* and carried further toward completion our knowledge of the plants and phytogeography of Florida during several weeks exploration in April and May, and also during a short trip in December. A report on the field work of these excursions is in preparation, as are also a number of papers or monographs on various groups of plants on lines suggested by observations during recent and current field work and augmented by study collections. In connection-too, with our spring excursion, Miss Mary E. Eaton, Artist, detailed by you to go to Florida, made twenty-odd paintings of rare or otherwise interesting flowering plants of southern Florida for forthcoming issues of *Addisonia*. I have published two small illustrated handbooks on the ferns of

several regions in extreme southern Florida and made an investigation of the fern flora of the whole state of Florida, which I hope to publish with illustrations and descriptions.

Respectfully submitted,

JOHN K. SMALL,
Head Curator of the Museums and Herbarium.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1918.

Owing to the crowded condition of certain sections of the library, it seemed imperative that additional shelving space should be provided. This was secured by the vacating of two stacks in the room at the west of the main reading room, formerly filled with books belonging to the bibliographer. Since the moving of the entire library was involved in this change, work was commenced on September 1 and continued until early in October, when the end of the east stacks was reached.

At that time the greatly needed work of repairing the walls of the stack room was begun and completed within a month. This has greatly improved the appearance of the library, and it is hoped will prevent the leakage of water in the future. The necessary cleaning of books has interfered with the further work of moving, but this has now been resumed and will be pushed to completion.

This additional shelving space will probably suffice for normal growth during a period of two years.

The librarian's office has been temporarily transferred from the library to the room at the west of the main reading room, thus ensuring greater comfort during the winter months.

The census taken at the end of the year shows a total of 29,237 bound volumes, a net gain of 703 over the census of a year ago.

During the year only 216 books have been bound, including 13 which are the property of Columbia University. A large number of the older books of the collection are in need of rebinding, and it is hoped that funds for this purpose may be available during the coming year.

The accessions have been listed as usual in the *Journal*. The principal purchases were 32 bound volumes and 178 pamphlets from the library of the late Dr. C. B. Robinson, and 227 bound volumes and 102 pamphlets from that of Dr. J. H. Barnhart, the former consisting chiefly of works relating to the flora of Canada and the Philippine Islands, and the latter of sets of periodicals and publications of scientific societies and institutions. There was also purchased from the Hempstead Plains Library the *Sertum palmarum brasiliensium* by J. Barbosa Rodrigues, as noted in the November *Journal*.

Last year a large number of excerpts from popular magazines which the Garden would be unlikely ever to have on file were purchased, and this year 265 similar papers were added to the collection. These relate chiefly to economic botany and forestry.

The books received as gifts during the past year number 74, while those acquired by exchange and deposit were 26.

There have been added to the catalogue 1,361 written and typewritten cards, in addition to the printed cards issued by the Torrey Botanical Club. Work upon the revision of the catalogue has been continued as opportunity has presented itself.

As noted in the November *Journal*, several shipments of German periodicals have been received. This has been accomplished through the agency of the American Library Association which holds a permit for such importations. The subscriptions for 1919 have been placed in the same manner.

The following additions and corrections should be made to the periodical list as appended to the report of the Librarian for 1916 (*Bulletin* 9: 342–363) and supplemented in the report for 1917 (*Bulletin* 9: 449, 450):

Omit § before the following:

* Biologisches Centralblatt.
* Botanisches Centralblatt.
† Botanisches Centralblatt, Beihefte.
* Centralblatt für Bakteriologie: Abth. I, II.
* Flora.
* Jahrbücher für wissenschaftliche Botanik.
* Zeitschrift für Botanik.
* Zeitschrift für induktive Abstammungs- und Vererbungslehre.
* Zeitschrift für wissenschaftliche Mikroskopie.

Change † to *:

Botanisches Centralblatt, Beihefte.

Insert * before the following:

American Florist.
Arnold Arboretum. *Bulletin of Popular Information.*
Garden Magazine.
Gardening.
Hardwood Record.
India Rubber World.

Add the following:

* American Society for Horticultural Science, College Park, Md. *Proceedings.*
* Botanical Abstracts, Baltimore, Md.
Brooklyn Botanic Garden, Brooklyn, N. Y. *Memoirs.*
* Journal of General Physiology, Baltimore, Md.
Tucuman. Universidad de, Tucuman, Arg. *Revista, Publicaciones.*
Virginia Truck Experiment Station, Norfolk, Va. *Bulletin.*

Omit the following:

Lorquinia.
Rural New Yorker.

Respectfully submitted,

SARAH H. HARLOW,
Librarian.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1918.

Although much of my time has been used in giving personal assistance both to my associates and to visitors

consulting the Library, more time than usual has been devoted to bibliographic research.

Only three parts of *North American Flora* have been issued during the year: Volume 21, Part 3, in January, and Volume 32, Part 1, and Volume 22, Part 6, during the closing days of December. The apparent break in publication was not accompanied by any cessation of work upon the *Flora*. It was due in part to temporary effects of the war—especially at the time of the second draft—upon the printers' trade, and in part to the number of authors contributing to Volume 22, Part 6, and the unusual amount of careful editorial work required by this part. This volume was commenced in 1905, thirteen years ago, and the part lately issued consists largely of additions required to bring it up to date. Much manuscript for the *Flora* is now in hand, and much more is nearly ready, so that the prospects for its rapid appearance are better than ever.

Addisonia has appeared as usual, and the third volume is now complete. This young periodical has already illustrated, in color, on 120 plates, 122 different flowering plants, belonging to 93 different genera, and representing 51 natural families. The genus most largely represented, so far, is *Echeveria*, with five species; *Opuntia* and *Aster* are tied for second place, with four species each. Of the families, Crassulaceae and Carduaceae are represented by fourteen species each, Orchidaceae by eleven, and Cactaceae by ten. A complete list is given on the third and fourth cover-pages of the last number, but the list is growing so long that the practice of repeating it in its entirety with each number must soon be abandoned.

There have been no extraordinary additions to the Library during the year. The most noteworthy ones are mentioned specifically in the report of the Librarian.

Respectfully submitted,

JOHN HENDLEY BARNHART,

Bibliographer.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1918.

General Matters

The strictest economy has been exercised during the past year in all matters under my charge. The positions of the assistant in laboratory work and of the assistant in propagating work have become vacant and have not been filled. Only the most necessary of supplies have been purchased and no new equipment has been installed.

Records of meteorology have been taken and the programs arranged for monthly conferences of the scientific staff and students of the Garden, of which reports have been published in the *Journal*.

Personal Investigations

During the past few years most of my research as well as that of various students has been largely directed to studies of fertility and sterility. The experiments have aimed to determine the occurrence, the nature, and the heredity of various types of sterility and the rather practical question of the effects of selection and inbreeding. For these purposes species of *Cichorium*, *Plantago*, *Verbascum*, *Nicotiana*, *Ammocallis*, *Lythrum*, *Linum*, and *Eschscholtzia* have been grown during the year. Studies of fertility and sterility in plants propagated vegetatively have also been continued especially in *Narcissus* and *Hemerocallis*. In conducting further work it seems desirable (1) to make a further general survey to determine the various types of sterility and (2) to center intensive study on species which exhibit the various types of sterility, are favorable for cultivation, and which may also be of some economic importance. I should be pleased to expand the work to include cases of the latter. Numerous problems connected with these studies are especially well adapted for student research and cooperation.

Further plantings of *Hibiscus* and *Phlox* were not made during the year. The greater number of *Hibiscus* plants, comprising pedigreed lines of pure species, of varieties and of inter-varietal and inter-specific hybrids, have been turned over to you for special display plantings. One series of plants grown from seed collected near Washington, D. C., and reported to be *Hibiscus incanus*, bloomed during the summer and exhibited striking resemblance to *H. oculiroseus* in respect to flower and pod characters. Further field studies of *Hibiscus* are desirable especially in the regions of southern and western range.

Under your general supervision I conducted during the summer and autumn an experiment to determine the effect of potash on the growth of beans. The results have been submitted to you and were printed in the December number of the *Journal.*

Special plantings of tulips for continued study of rots, blindness, and abnormal growth suffered severe injury through depredations of pine mice. General observations were made, as in previous years, of the performance of tulips in the display plantings. Several problems in tulips of considerable practical interest await further study.

In general my studies during the year have been more intensive than extensive. This has reduced the number of plants grown, the space utilized in greenhouse and experimental plots, and the amount of labor involved.

During the year four papers embodying results of researches have appeared in various scientific publications and two descriptions of *Hibiscus* species have been written for *Addisonia.* The final and complete report of the statistical studies of flower number in *Cichorum Intybus*, which have been in progress from 1912 to 1916 inclusive, was one of these papers, and in the preparation of this Miss Helene Boas was a joint author. The record of students and investigators at our garden (1897–1918) was also revised to date and was published in the *Journal* for October.

Special Investigators, Students and Scholars

There has been a decided decrease in student activities during the past year. Of the special investigators mention should be made of Professor John W. Ritchie and Mr. C. H. E. Redding who have continued experimental studies begun in previous years as reported.

List of Students

The following were formally registered for research in connection with studies for degrees. All satisfied tuition charges either at Columbia University or at the Garden.

Adams, James Fowler. *Pathology.*
Coker, Dorothy. *Mosses.*
Stevenson, Mrs. F. (Bermen, Florence Julia). *Variegation in Tussilago.*
Twiss, Wilfred Charles. *Taxonomy.*

List of Scholars

Gleason, Henry Allan. *The genus Vernonia.*

Respectfully submitted,
A. B. Stout,
Director of the Laboratories.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1918.

Regulating and Grading

We removed about 800 yards of earth from the coal bunker for power house no. 2, of which 300 yards were used at the Newell Avenue entrance to grade the lowland, 300 yards for grading at the magnolia collection and 200 yards to grade around the new buildings at conservatory range 2. The northern bank of the Rose Garden was graded with 250 yards of topsoil which had been removed from the paths at the southern end of the Magnolia Collec-

tion. Both sides of the stairway and the northern and western bank of the Rose Garden were graded and sodded for a distance of 200 feet on the western bank and 100 feet on the northern. Considerable grading was accomplished on the eastern side of the grounds near the School Garden section.

About 3,000 yards of fill were hauled into the Garden by outside contractors and placed on the new road north of Rose Garden. This fill was carted in at the expense of the contractors who were looking for a convenient place to dispose of it.

About 2,500 yards of stone were blasted and removed from the two quarries in the Garden. The stone removed from the quarry near conservatory range 2, amounting to nearly 2,000 yards, was used to extend the size of the coal bunker at power house 2 and for the paths on the eastern side of the grounds. The remainder of the stone was taken from the quarry near the museum building and was used in the construction of paths on the lower side of the Horticultural Gardens.

Drainage

In order to drain the Rose Garden two catch-basins were built, for which we used 188 feet of 4-inch tile pipe and 50 feet of 3-inch porous pipe. To drain the Horticultural Gardens at the lower end near the road, one catch-basin and three culverts were built with 156 feet of 4-inch tile pipe. A ditch 200 feet long was built and lined with boulders near the road at the northeastern corner of the Horticultural Gardens. We also built a culvert on the eastern side of the grounds under the path running south from the School Garden. We put in one catch-basin in order to drain the northern end of the Magnolia Collection. In changing the position of the drinking fountain at the Iris Garden, 72 feet of 3-inch tile pipe were used. It was necessary to change this fountain so that the waste water outlet might be connected with the sewer.

Paths

A path 10 feet wide and 85 feet long was constructed on the northern bank of the Rose Garden to connected the upper part with the stairway. At the bottom of the steps in the Rose Garden a path 45 feet long and 10 feet wide was completed. A 10-foot path 185 feet long was completed at the southern end of the Rose Garden leading through the canyon and also an 8-foot path 200 feet long. A path 500 feet long and 10 feet wide on the eastern side of the School Garden running to the southeastern entrance of the grounds and another 270 feet long and 10 feet wide running north at the School Garden were completed.

A 25-foot road, 75 feet long, was lined with stone and made ready for paving at the eastern entrance of conservatory range 2. In the Magnolia Collection a 10-foot path 385 feet long was paved and made ready for screening. All the paths on both sides of the Bronx River in the Salicetum were repaired, ashed and rolled down. To connect the Iris Garden with the Horticultural Gardens a 10-foot path 400 feet long was paved and ashed. At the southern end of the Magnolia Collection 350 feet of a 10-foot path have been lined and made ready for paving.

All the paths in the Horticultural and Rose Gardens were reashed and rolled. The path through the Hemlock Grove to the bridge at the falls was resurfaced.

Buildings

The front steps of the museum building were repointed and the interior of the library rear wall was remodeled and plastered. The wall and ceiling of the typists' room was repaired. This work was done by the masons. Other minor plaster repair work was accomplished throughout the building. Several of the doors, windows and cases of the museum building were repaired by the carpenters. Twelve new herbarium cases were built by a contractor for museum specimens. The steam engineers made all necessary repairs to steam leaks in the museum building and the water system was repaired by the plumber.

The framework, sash and doors of conservatory range 1 have received considerable repairs by the carpenters. The painter has replaced at least 500 lights of glass and painted the exterior of houses 1, 13, 14, 15, and 9. The steam engineers repaired all leaks and put in new pipes in houses 2, 3, 14, and 15 and have replaced the decayed pipes throughout the range. The plumber made numerous repairs to the leaders and the water system.

The brickwork of the boilers in power house 1 was rebuilt. The taps in all boilers were repaired. A conveyor for ashes and soot was constructed by our own men.

Owing to the shortage of coal, all the plants at conservatory range 2 were removed to conservatory range 1 during the first week of January, the water and steam being turned off in the former range. The carpenters made necessary repairs to the sash and doors and the painter replaced all broken glass and painted the exterior of four houses. The coal bunker at power house 2 was extended to 47 feet by 15 feet by 29 feet to enable us to increase the storage capacity with an additional 300 tons. This was constructed by our own men.

Considerable repairs have been made to the stable and propagating houses by the carpenters. They have also repaired the roof of the mansion and the interior in various parts. Two rooms to be used for School Garden work have been painted on the third floor. The comfort stations have been put in working order and all necessary repairs made by the plumber.

Twenty-eight tubs for plants were built for conservatory range 2.

Grounds

The carpenters completed a shelter house at the School Garden. Necessary repairs were made to the other shelter houses. The carpenters built eight rustic benches and repaired those that were broken. Twenty-four signs were repaired, painted and relettered by our employees.

Sufficient wood was cut to supply the propagating houses

for four months and the mansion for two months by running the gasoline engine for two weeks. We have continued to uproot the poison ivy throughout the grounds.

On Saturdays, Sundays, and holidays from June to September, we had two city officers in civilian clothes and with our two regular keepers and twelve additional guards, selected from the gardeners and laborers, the grounds have been well protected. At all other times during the year one city officer was detailed to the Garden. The number of visitors on Saturdays and Sundays during the summer months averaged about 40,000. This number was greatly increased during July and August. Owing to the watchfulness of our employees little damage has been done to the plantations throughout the Garden during the year.

A wire fence, three feet high, has been erected to protect the 2,500 red pines which have planted near the Iris Garden.

Respectfully submitted,

ARTHUR J. CORBETT,
Superintendent of Buildings and Grounds.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1918.

Our work has been of exceptional extent and importance. The Scientific Directors authorized the preparation of a guide book to the economic museum. This work was begun at the earliest practicable date thereafter and has occupied all of my available time since, with such needed assistance as you have assigned me. All the articles in the western half of the museum room, numbering more than 4,000, have been catalogued, and this manuscript, with the exception of some minor details now being completed, is ready for the printer. Work in the eastern half of the room will proceed without delay and will be much

simpler, and occupy less time than that already completed. The work of cataloguing has necessitated much rearrangement, both as to sequence and correlation, and improvement of appearance.

The plan has called for the consecutive numbering of all articles, the numbers being affixed to the specimens or their containers and to their labels, and being entered in the catalogue. This method will effectually prevent future misplacements and errors of identity. Additional specimens hereafter acquired will be given the appropriate integral number, followed by a decimal. Many specimens, acquired since the work was begun, have already been numbered in this way.

The classification of the collections heretofore prevailing has been maintained, the primary division being economic, into fibers, resins, rubbers, condiments, foods, drugs, etc. The articles in each of these classes, wherever appropriate, have been subdivided according to the parts of the plant represented, such as roots, leaves, fruits, and seeds. In each of these subdivisions, the articles have been arranged in the botanical sequence of their families and, in the case of large families, of their genera. This arrangement, while affording an economic basis that appeals naturally to the ideas and convenience of visitors and students interested in this feature of the exhibits, at the same time preserves scientific relations and affords convenient reference for the taxonomist.

In preparing the reading matter of the guide book accompanying the respective numbers, I have given the principal common or popular names, followed by the definitions, comprising the botanical name, including its author or authors, and a statement of the part of the plant represented. In many cases also the definition contains a brief statement of the state or conditions of the plant part, as when the latter has undergone artificial treatment in preparation. Then follows the family names, scientific and popular, unless there is a family heading for a group

of articles. The nativity of the species is then stated, followed by a record of the source of the specimen, as to production, collection and donor. Special attention is given to the last mentioned portion of the record, in order to fix as perfectly as possible the authenticity of the article. In many cases, reference is made to the existence of the living plant in our conservatories or grounds, and to herbarium specimens representing the same collection as that of the museum specimen.

The systematic work, carried on as above described, has disclosed the existence of hundreds of omissions of important articles, many of them capable of being secured with relatively little trouble or expense. A list of such articles has been prepared and their accumulation has been commenced, nearly a hundred having been secured since work on the guide was started. Many others will call for greater efforts, and some expenditure, during the coming season. Their addition to the museum at this particular time, with their resulting inclusion in the guide, is a matter of great importance, and I trust that no failure to make the necessary provision for this work may be permitted. To do so would cause a serious imperfection in a work that will have a very extensive use for years to come. I am prepared to devote the coming season chiefly to this work, if the necessary means are provided. We can probably arrange with botanists living in various localities to collect for us about half of the articles, at very little expense. For the collection of others, I should have to do some traveling and collecting in person. I earnestly request that a special appropriation of five hundred dollars be made for this work.

The portion of the work already completed has consumed almost the entire supply of jars provided for the year. About five hundred more, of various sizes, mostly medium, will be required for its completion, in addition to a lot of three hundred, of small size, to contain a special collection of rice samples, donated by Mr. E. B. Southwick.

Fully a thousand labels will be required for the additional articles. By the temporary use of typewritten labels this expense could readily be postponed until more money is available.

In conclusion, I again urge the careful consideration of the above requirements. I believe that no other want has been more often expressed by visitors than that of the guide that we are preparing. This work having now been undertaken, it should be as well done as our circumstances permit.

Respectfully submitted,

H. H. Rusby,

Honorary Curator of the Economic Collections.

REPORT OF THE HONORARY CURATOR OF THE COLLECTIONS OF FOSSIL PLANTS

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to report as follows upon activities in connection with the paleobotanical collections of the Garden during the year 1918.

Study was continued and drawings made of specimens of fossil plants contained in the collection made in Porto Rico by the joint natural history survey of the New York Academy of Sciences and the American Museum of Natural History.

During the latter part of the year I have been engaged in overhauling the paleobotanical material in the latter institution and arranging a series of specimens on a taxonomic basis for display in connection with the general paleontological taxonomic exhibit of the Museum.

Incidental to this work it has been my privilege to examine, assort, and identify as far as possible the collections of fossil plant material brought from Greenland by the Arctic Expedition of the Philadelphia Academy of Natural Sciences, under command of Robert E. Peary, C.E. (now Rear Admiral), U. S. Navy, in 1891–92. This material is mostly in the form of large fragments of matrix,

collected at Atanèkerdluc on the south shore of Nugsuaks Peninsula on the shore of the Vaigat, which separates the peninsula from Disco Island. By arrangement with the Garden a selected lot of this material will be exchanged for duplicate material from the Garden collections. Fossil plants from Greenland have heretofore been entirely lacking in the Garden collections and an interesting and valuable accession has thus been assured.

Respectfully submitted,

ARTHUR HOLLICK,
Honorary Curator of the Collections of Fossil Plants.

REPORT OF THE HONORARY CURATOR OF MOSSES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: No mosses have been purchased during the year; 690 specimens have been received and 2566 duplicates have been sent out in exchange; to the Bureau of Science in Manila, Philippine Islands, we have sent 678 and received in exchange 205 specimens; to H. N. Dixon, of Northampton, England, 414 duplicates from the Mitten collection, and 8 other packages are awaiting shipment; to the National Museum, 397 specimens; to Mt. Holyoke Colege, 150 Eastern North American mosses; to Dr. A. LeRoy Andrews, 285 miscellaneous duplicates; to Prof. J. M. Holzinger, 234 specimens; and to Mr. A. T. Beals, 67 specimens of *Ephemerum* for photographing. We have received for determination from the Philadelphia Academy of Natural Sciences, 35 mosses and hepatics collected in the Canadian Rockies, and from the Colegio de la Salle, Cuba, 150 mosses and hepatics. From Dr. E. O. Hovey, of the American Museum of Natural History, 50 plants have been received including some flowering (10) and the rest flowerless, collected by him at North Star Bay, Greenland, on the relief to the MacMillan Expedition. We have continued our exchanges with the members of the Sullivant Moss Society, of which I have been President during the

year, and the Curator of Mosses, Mr. Kaiser, has assisted in the determinations of the mosses sent in for study.

During the late winter and spring, Miss Dorothy Coker has made a critical study of the North American species of *Encalypta*, under my direction, and we have reduced the number of recognizable species from 18 to 8. The descriptions of the mosses for the "Flora of the Bahamas" have been completed.

Acting as Secretary for the Stokes' Fund and the Wild Flower Preservation Society, I have answered all letters pertaining to this subject and have delivered a number of lectures on Arbor Day and Conservation topics to Public Schools in The Bronx.

Owing to War Activities, the Garden Clubs have devoted themselves mostly to farm and garden work, but the Litchfield, Connecticut, Garden Club invited me to address them in June and gave me the opportunity to visit the large area of native forest which is owned and protected from vandalism by two of its members.

My interest in the lantern-slide collection has been continued; a set of fern slides from Mr. Ransier and 64 colored slides of Colorado plants from the American Museum of Natural History have been given to the collection.

Respectfully submitted,

ELIZABETH G. BRITTON,
Honorary Curator of Mosses.

CONTRIBUTIONS TO EMERGENCY FUND OF 1918 UP TO JULY 23

Transferred from Cherry Garden Shelter Fund subscription	$1,000
Mr. Fritz Achelis	100
Mr. Edward D. Adams	300
Mrs. Robert Bacon	100
Mr. George F. Baker	100
Mr. Andrew Carnegie	500
Mrs. Charles D. Dickey	100
Mr. Cleveland H. Dodge	250
Mr. Daniel Guggenheim	250
Mr. Murry Guggenheim	250
Dr. Walter B. James	100
Mrs. John Innes Kane	100
Mr. Adolph Lewisohn	100
Mrs. V. Everit Macy	100
Mr. William J. Matheson	100
Mr. J. P. Morgan	500
Mr. Geo. W. Perkins	250
Mr. Charles F. Rand	100
Mr. Edwin A. Richard	100
Mr. William Rockefeller	100
Mr. Jacob H. Schiff	100
Mrs. Henry O. Taylor	100
Mr. Myles Tierney	100
Mr. Louis C. Tiffany	200
Mr. W. K. Vanderbilt	300
Total	$5,300

SCHEDULE OF EXPENDITURES DURING THE YEAR 1918

1. CITY MAINTENANCE ACCOUNT

Allowance		$119,835.00
	Expended	
Salaries	$83,473.00	
Labor	6,280.95	
Total		$89,753.95
Forage	1,521.93	
Fuel	19,152.46	
Supplies	1,881.83	
Equipment	1,180.32	
Materials	4,471.18	
Repairs	1,219.52	
Telephone service	222.43	
Contingencies	431.38	
Total		$30,081.05
Total Expended		$119,835.00

2. SPECIAL GARDEN ACCOUNTS

Exploration Fund

Balance from 1917		*$ 24.05*

Museum and Herbarium Fund

Balance from 1917	*$ 71.90*	
Less Vouchers transferred from Income, Science and Education Fund	$ 45.82	
Balance		*$ 26.08*

Plant Fund

Balance from 1917	*$ 338.40*	
Sales of hay	$ 563.75	
Total		$ 902.15
Expended		$ 399.80
Balance		*$ 502.35*

Special Book Fund

Balance from 1917	*$ 101.26*	
Contribution	40.00	
Sale of books	7.09	
Total		$ 148.35
Expended		69.49
Balance		*$78.86*

ROSE GARDEN AND GARDEN EXTENSION FUND		
Balance from 1917	$ 33.85	
Less-Recharged to adjust error on Voucher No. 77	$ 20.00	
Balance		$ 13.85
GARDEN SCHOOL FUND. CONTRIBUTION ACCOUNT		
Balance from 1917		473.18
Contributions	$ 4,015.00	
Students and Lecture fees	163.75	
Sale of tools and implements	3.00	
Sale of books	3.16	
		$ 4,184.91
Total		$ 4,658.09
GARDEN SCHOOL FUND. APPROPRIATION ACCOUNT		
Appropriated		$ 4,500.00
Expended		
Salaries	$ 1,306.65	
Miscellaneous	52.07	
Total		$ 1,358.72
Balance		$ 3,141.28
GUGGENHEIM GREENHOUSE FUND		
Balance from 1917		$ 90,027.99
Expended		
Salaries	$ 542.50	
Labor	2,371.16	
Contracts	32,716.50	
Miscellaneous	1,180.68	
Total		$ 36,810.84
Balance		$ 53,217.15
SCHOOL GARDEN SUMMERHOUSE FUND		
Balance from 1917	$ 1,381.44	
Refund to adjust over payment on Voucher No. 31	30.00	
Total		$ 1,411.44
Expended		
Salaries	$ 360.00	
Labor	268.00	
Contracts	525.00	
Miscellaneous	163.94	
Total		$ 1,316.94
Balance		$ 94.50

EMERGENCY FUND

Balance from 1917	$ *100.13*	
Contributions	5,300.00	
Total		$ 5,400.00
Expended		
Salaries	$ 1,621.25	
Labor	1,819.45	
Miscellaneous	1,942.34	
Total		$ 5,383.04
Balance		$ *17.09*

SUMMARY OF SPECIAL GARDEN ACCOUNTS

Balances from 1917	*$92,516.38*	
Contributions and Fees	9,518.75	
Sales	577.00	
Total		$102,612.13
Expended		45,338.83
Balance		$ *57,273.30*

3. SPECIAL INCOME ACCOUNTS

		Appropriated	*Expended*	*Balances*
Income of Science and Education Fund				
Publications		$ 884.81		
Herbarium		517.22		
Lectures		798.11		
Photography		46.29		
Laboratories		355.35		
Exploration		1,223.59		
Total	$ 4,000.00	$ 3,825.37	$	*174.63*
Income of Darius O. Mills Fund.				
Museums		$ 811.12		
Books and Binding		578.85		
Investigations at other Institutions		107.93		
Total	$ 2,000.00	$ 1,497.90	$	*502.10*
Accumulated Income of Henry Iden Fund.				
Books	$ 500.00	$ 475.00	$	*25.00*
Income of William R. Sands Fund.				
Horticultural Prizes	$ 350.00	$ 316.00	$	*34.00*
Accumulated Income of Olivia E. and Caroline Phelps Stokes.				
For the Preservation of Native Plants	$ 150.00	$ 14.50	$	*135.50*
Accumulated Income of Students Research Fund.				
Aid for Students Research	$ 500.00	$ 100.00	$	*400.00*
Income of David Lydig Fund.				
Publications	$ 4,000.00	$ 2,886.36	$	*1,113.64*

Accumulated Income of Addison Brown Fund.			
For Preparation, Publication and Distribution of Addisonia.			
Salary of Artist		$ 330.00	
Printing		3,622.78	
Miscellaneous		352.58	
Total	$ 4,325.00	$ 4,305.36	$ 19.64
	Appropriated	*Expended*	*Balances*
Income of John Innes Kane Fund.			
Plants for Grounds and Greenhouses	$ 500.00	$ 483.31	$ 16.69
Income of Maria DeWitt Jesup Fund.			
For Increase of the Collections			
Books		$ 470.04	
Specimens		423.31	
Total	$ 1,000.00	$ 893.35	$ 106.65
Accumulated Income of Charles Budd Robinson Fund.			
For aiding Exploration	$ 80.00	$ 50.00	$ 30.00
Income of Guggenheim Greenhouse Fund.			
Salaries		$ 375.00	
Labor		1,274.00	
Miscellaneous		3,002.77	
Total	$ 5,000.00	$ 4,651.77	$ 348.23
Totals—Special Income Accounts	$22,405.00	$19,498.92	$ 2,906.08

4. GENERAL INCOME ACCOUNT

	Appropriated	*Expended*	*Balances*
Insurance.			
Boilers and Elevators		$ 126.72	
Museum Specimens and Books		366.60	
Horses and Wagons		11.00	
Total	$ 504.32	$ 504.32	
Supplies (including Circulars for Members).			
Circulars		$ 223.79	
Supplies		972.15	
Total	$ 1,200.00	$ 1,195.94	$ 4.06
Contingent Fund.			
Miscellaneous	$ 695.68	$ 694.36	$ 1.32
Entertainment.			
Refreshments		$ 116.00	
Hire of touring cars		74.50	
Printing and postage		174.50	
Total	$ 400.00	$ 365.00	$ 35.00
	Appropriated	*Expended*	*Balances*

Assistance for Treasurer.			
Services rendered	$ 540.00	$ 480.00	$ *60.00*
Salaries.			
Individual accounts		$14,246.70	
Miscellaneous		1,009.33	
Total	$15,260.00	$15,256.03	$ *3.97*
Labor.			
Weekly Pay Rolls		$ 991.30	
Guard Duty		572.30	
Miscellaneous overtime		474.50	
Total	$ 2,100.00	$ 2,038.10	$ *61.90*
Plans, Surveys and Construction.			
Salaries		$ 620.00	
Labor		297.20	
Construction		2,703.28	
Miscellaneous		369.79	
Total	$ 4,000.00	$ 3,990.27	$ *9.73*
Totals—General Income Account	$24,700.00	$24,524.02	$ *175.98*

5. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts	$45,338.83
Special Income Accounts	19,498.92
General Income Account	24,524.02
Total	$89,361.77

6. BOARD ROOM FUND

January 1, 1918. Balance—Cash			*45.99*
Gross Receipts—January to December	$ 156.84		
Less—Credited to Income of Lydig Fund	*3.89*		
Total Net Receipts	$ 152.95	$ 152.95	
Total		$ 198.94	
Disbursements.			
Supplies	$ 108.17		
Contingencies	36.45		
Total		$ 144.62	
December 31, 1918. Balance—Cash		$ *54.32*	

Respectfully submitted,
WALTER S. GROESBECK,
Bookkeeper.

E. and O. E.
NEW YORK, January 13, 1919.

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

(*Received and ordered printed January 13, 1919*)

To the Board of Managers of the New York Botanical Garden.

Sirs: The scientific directors of the Garden have held their regular meetings through the year and have advised with the Director-in-Chief in all matters of general policy which have come up. In the work of the year we note especially the opportunities for more effectively promoting interest in rare and beautiful blooming plants, tropical fruits, etc., which will come with the completion of the large combined display conservatory and lecture pavilion provided by the gifts of Messrs. Daniel and Murray Guggenheim.

Of great importance also is the possibility now opening up of undertaking work in cooperation with the Federal Board of Vocational Training in teaching the elements of gardening and horticulture to partially disabled and convalescent soldiers. The work thus started may lead finally to the successful establishment on a permanent and financially adequate basis of a school for Gardeners such as has been long needed in this country.

The constructional, scientific and educational work of the year is fully reported by the Director-in-Chief and need not be further summarized here.

Respectfully submitted,

R. A. Harper,

Chairman of the Scientific Directors.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS AND MEMBERS FOR THE YEAR 1918

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 41. The number of annual members is now 881; life members 141; sustaining members 14; fellowship members 2.

Of these 23 are now in arears for dues for 1918, 15 for dues for 1917 and 1918, 7 for dues for 1916, 1917 and 1918.

Dues have been collected to the amount of $9210. One person has qualified as a life member by the payment of $250. These sums have been transmitted to the treasurer.

A complete list of all classes of members to date is herewith submitted.

Benefactors

*Hon. Addison Brown,
Andrew Carnegie,
Columbia University,
*Hon. Chas. P. Daly,
Daniel Guggenheim,
Murry Guggenheim,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
*Cornelius Vanderbilt.

Patrons

Oakes Ames,
*Miss Catherine A. Bliss,
Dr. N. L. Britton,
*Hon. Addison Brown,
Andrew Carnegie,
*Mrs. George Whitfield Collord,
*James M. Constable,
*William E. Dodge,
James B. Ford,
George J. Gould,
Edward S. Harkness,
*Mrs. Esther Herrman,
Archer M. Huntington,
*Henry Iden,
Mrs. John Innes Kane,
*John Stewart Kennedy,
*J. Pierpont Morgan, Sr.,
*Oswald Ottendorfer,

* Deceased.

*Lowell M. Palmer,
William Rockefeller,
*William R. Sands,
*William C. Schermerhorn,
*James A. Scrymser,
Mrs. Finley J. Shepard,
*Samuel Sloan,
Mrs. Frederick F. Thompson,
W. K. Vanderbilt,
Mrs. Antoinette Eno Wood.

Fellows for Life

Edward D. Adams,
George F. Baker,
Miss Elizabeth Billings,
Mrs. W. Bayard Cutting,
Dr. Robert W. de Forest,
Cleveland H. Dodge,
James B. Ford,
Daniel Guggenheim,
Murry Guggenheim,
S. R. Guggenheim,
Mrs. John Stewart Kennedy,
Edward V. Z. Lane,
Mrs. Frederic S. Lee,
James McLean,
Ogden Mills,
George W. Perkins,
Mrs. John A. Roebling,
Mortimer L. Schiff,
Francis Lynde Stetson,
Miss Olivia E. Phelps Stokes,
Charles G. Thompson,
Louis C. Tiffany,
Tiffany & Company.

Life Members

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Mrs. James Herman Aldrich,
Constant A. Andrews,
J. Sherlock Andrews,
Dr. S. T. Armstrong,
Edward W. C. Arnold,
Mrs. H. D. Auchincloss,
Samuel P. Avery,
Samuel D. Babcock,
Dr. John Hendley Barnhart,
George D. Barron,
Aurel Batonyi,
Gustav Baumann,
Samuel R. Betts,
William G. Bibb,
Miss Elizabeth Billings,
J. O. Bloss,
George Blumenthal,
G. T. Bonner,
Mrs. Addison Brown,
J. Hull Browning,
Joseph Bushnell,
T. Morris Carnegie,
Frank R. Chambers,
Hugh J. Chisholm,
Hugh J. Chisholm, Jr.,
Geo. C. Clark,
Banyer Clarkson,
Dr. James B. Clemens,
Wm. F. Cochran,
William Colgate,
Miss Georgette T. A. Collier,
W. E. Connor,
Mrs. F. A. Constable,
Theodore Cooper,
Zenas Crane,
R. N. Cranford,

Melville C. Day,
Charles Deering,
Mrs. John Ross Delafield,
Miss Julia L. Delafield,
Maturin L. Delafield, Jr.,
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James Douglas,
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Miss Ethel DuBois,
Miss Katharine DuBois,
Wm. A. DuBois,
Geo. E. Dunscombe,
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Newbold Edgar,
George Ehret,
Ambrose K. Ely,
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Franklin L. Gunther,
Frederic R. Halsey,
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Mrs. Columbus O'D. Iselin,
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Dr. Walter B. James,
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W. B. Kunhardt,
Charles Lanier,
W. V. Lawrence,
Meyer H. Lehman,
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Mrs. Wm. H. Macy, Jr.,
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William J. Matheson,
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Guy R. McLane,
Emerson McMillin,
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A. G. Mills,
Dr. Lewis R. Morris,
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F. Aug. Schermerhorn,
Jacob H. Schiff,
Mortimer L. Schiff,

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Geo. Sherman,
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Mrs. Frederick F. Thompson,
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Dr. W. Seward Webb,
Hon. Geo. Peabody Wetmore,
John D. Wing,
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E. A. Richard.

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John Greenough,
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William H. Porter,
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Benjamin Abert,
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E. Asiel,
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James Gordon Bennett,
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E. R. T. Berggren,
Isaac J. Bernheim,
Chas. L. Bernheimer,
Philip Berolzheimer,
S. Reading Bertron,
Edward J. Berwind,
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Abraham Bijur,
Samuel H. Bijur,

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C. Edw. Billquist,
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Samuel Bird, Jr.,
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J. Insley Blair,
T. Whitney Blake,
C. N. Bliss, Jr.,
Miss S. D. Bliss,
Mrs. Walter P. Bliss,
Hugo Blumenthal,
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Mrs. Edward C. Bodman,
Henry W. Boettger,
Robert Boettger,
Theodore Boettger,
William H. Bolton,
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Louis Boury,
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B. Ogden Chisolm,
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E. W. Coggeshall,
William N. Cohen,
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Mrs. Rufus Cole,
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Samuel P. Colt,
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T. G. Condon,
Hermann Conheim,
Roland R. Conklin,
J. N. Conyngham,
Arthur N. Cooley,
Marin LeBrun Cooper,
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C. R. Corning,
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Geo. F. Crane,
Mrs. Jonathan H. Crane,

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Robert L. Crawford,
William Crawford,
Mrs. Thomas Crimmins,
W. T. Crocker,
James W. Cromwell,
Mrs. Joseph F. Cullman,
G. Warrington Curtis,
R. Fulton Cutting,
Mrs. Barton Cuyler,
Miss Eleanor De Graff Cuyler,
Jean De Saint Cyr,
Mrs. Ira Davenport,
J. Clarence Davies,
Julien T. Davies,
Alvah Davison,
Clarence S. Day,
Henry Dazien,
O. de Comeau,
Dr. Robert W. de Forest,
Mrs. Robert W. de Forest,
John F. Degener, Jr.,
B. F. DeKlyn,
J. R. Delamar,
Eugene Delano,
Moreau Delano,
John B. Dennis,
Rev. H. M. Denslow,
Walter D. Despard,
Countess de Laugier-Villars
William G. De Witt,
J. Henry Dick
Geo. H. Diehl,
Chas. F. Dieterich,
Miss Josephine H. Dill,
Miss Mary A. Dill,
Miss Gertrude Dodd,
Cleveland H. Dodge,
Francis P. Dodge,
Otto L. Dommerich,

Charles Doscher,
Henry Doscher,
Mrs. George William Douglas,
Mrs. James Douglas,
Alfred Douglass,
Tracy Dows,
J. R. Drexel,
Isaac W. Drummond,
Dr. Matthew B. Dubois,
Mrs. Matthew B. Dubois,
Mrs. John P. Duncan,
Ralph Wurts Dundas,
Dr. Edward K. Dunham,
Mrs. T. Coleman du Pont,
E. G. Duvall,
John E. Dwight,
Mrs. Frederick H. Eaton,
Thomas C. Edmonds,
Mrs. J. S. Ehrich,
Mrs. Ernest Ehrmann,
Karl Eilers,
Henry G. Eilshemius,
August Eimer,
Monroe Einstein,
William Einstein,
Miss Kate Eisig,
Wm. D. Ellis,
Mrs. James W. Ellsworth,
Miss Lydia F. Emmett,
Robert Temple Emmett,
Mrs. Arthur B. Emmons,
R. Erbsloh,
Henry Esberg
Arthur F. Estabrook,
Louis Ettlinger,
S. M. Evans,
A. W. Evarts,
Mrs. Ernesto Fabbri,
Eberhard Faber,
Harris Fahnestock,

Chas. S. Fairchild,
Samuel W. Fairchild,
Percival Farquhar,
Mrs. Max Farrand,
James C. Farrell,
William L. Feeney,
Louis Ferguson.
Walton Ferguson,
William C. Ferguson,
Pliny Fisk,
Harry Harkness Flagler,
Mrs. John H. Flagler,
Mrs. Albert Flake,
Mrs. Joseph A. Flannery,
Nathan Fleischer,
Fred T. Fleitmann,
Isaac D. Fletcher,
Edward H. Floyd-Jones,
Franz Fohr,
L. G. Forbes,
Scott Foster,
Mrs. M. J. Fox,
Mrs. William Fox,
David J. Frankel,
R. A. Franks,
Miss Jane K. Fraser,
Miss S. Grace Fraser,
A. S. Frissell,
John W. Frothingham,
John H. Fry,
W. W. Fuller,
E. A. Funke,
Albert Gallatin,
Geo. F. Gantz,
Francis P. Garvin,
Mrs. Walter Geer,
John J. Gibbons,
R. W. Gibson,
Prof. William J. Gies,
Mrs. William J. Gies,
J. Waldron Gillespie,
Robert McM. Gillespie,
Mrs. S. D. Godfrey,
Mrs. Mary R. Goelet,
Julius Goldman,
Chas. Gotthelf,
Abraham L. Goldstone,
Philip J. Goodhart,
Miss Clara J. Gordon,
Chas. A. Gould,
Edwin Gould,
Mrs. W. R. Grace,
Rev. David H. Greer,
William G. Grieb,
Miss Margarette E. Griffith,
Miss Susan D. Griffith,
E. Morgan Grinnell,
George Bird Grinnell,
Mrs. Chester Griswold, Sr.,
A. M. Guinzburg,
W. S. Gurnee,
Mrs. Gurnee,
Mrs. C. S. Guthrie,
William D. Guthrie,
Miss Edith Haas,
John A. Hadden, Jr.,
Daniel S. Hage,
Hon. Ernest Hall,
Wm. Halls, Jr.,
Mrs. Charles W. Halsey,
Wm. Hamann,
L. Gordon Hamersley,
Miss Elizabeth S. Hamilton,
Mrs. William P. Hamilton,
Ferdinand Hansen,
J. Montgomery Hare,
E. S. Harkness,
Mrs. Stephen V. Harkness,
Mrs. Frank D. Harmon,
Miss Josephine T. Harriot,

William Hamilton Harris.
Jacob Hasslacher,
T. A. Havemeyer,
J. Woodward Haven,
Miss Caroline C. Haynes,
Mrs. W. R. Hearst,
Wm. W. Heaton,
Hancke Hencken,
Chas. Henderson,
Mrs.E. C. Henderson,
Harmon W. Hendricks,
Philip W. Henry,
Mrs. A. Barton Hepburn,
B. F. Hermann,
George B. Herzig,
Samuel A. Herzog,
H. H. Hewitt,
Mrs. James J. Higginson,
Hugh Hill,
Mrs. Robert Hill,
Walter Hinchman,
Mrs. Samuel N. Hinckley,
B. Hochschild,
Mrs. H. P. Hodson,
Richard M. Hoe,
Mrs. Richard March Hoe,
Mrs. Robert Hoe,
Bernhard Hoffmann,
Mrs. Edward Holbrook,
John Swift Holbrook,
Edwin T. Holmes,
Mrs. Elon Huntington Hooker,
Chas. H. Hoole,
Ernest Hopkinson,
Frederick B. House,
C. J. Housman,
M. D. Howell,
Mrs. Henry E. Howland,
John Sherman Hoyt,
Miss Rosina S. Hoyt,
Theodore R. Hoyt,
Walter C. Hubbard,
Conrad Hubert,
Mrs. E. W. Humphreys,
Mrs. H. E. Huntington,
Mrs. R. P. Huntington,
Dr. Lee M. Hurd,
H. D. Hutchins,
Frank DeK. Huyler,
Mrs. Clarence M. Hyde,
Henry St. John Hyde,
Edwin W. Inslee,
Adrian Iselin, Jr.,
C. Oliver Iselin,
Miss Georgine Iselin,
Lewis Iselin,
William E. Iselin,
Mrs. William E. Iselin,
Miss Flora E. Isham,
Dr. Abram Jacobi,
Samuel K. Jacobs,
John S. Jacobus,
A. C. James,
Mrs. Arthur Curtis James,
Dr. Robert C. James,
E. C. Jameson,
Mrs. Alfred Jaretzki,
Alfred W. Jenkins,
O. G. Jennings,
Walter B. Jennings,
George S. Jephson,
Gilbert H. Johnson,
Mrs. Townsend Jones,
Karl Jungbluth,
Henry M. Kahle,
Felix E. Kahn,
Louis Kahn,
Mrs. Delancey Kane,
Miss Louise Landgon Kane,
Mrs. H. F. Kean,

Frank Browne Keech,
Henry F. Keil,
William W. Kelchner,
Prof. J. F. Kemp,
Mrs.H.Van Rensselaer Kennedy,
Mrs. John S. Kennedy,
David Keppel,
Rudolph Keppler,
John B. Kerr,
Geo. A. Kessler,
Patrick Kiernan,
S. E. Kilner,
Alfred R. Kimball,
Mrs. Wm. M. Kingsland,
Darwin P. Kingsley,
Morris Kinney,
W. Ruloff Kip,
E. C. Klipstein,
Roland F. Knoedler,
Chas. Kohlman,
A. H. Kursheedt,
Adolf Kuttroff,
Francis G. Landon,
Edward V. Z. Lane,
Woodbury Langdon,
Mrs. Jacob Langeloth,
Mrs. John J. Lapham,
Lewis H. Lapham,
John Burling Lawrence,
Henry Goddard Leach,
Prof. Frederic S. Lee,
Lederle Antitoxin Laboratories,
Marshall C. Lefferts,
Wm. H. Lefferts,
George Legg,
James M. Lehmaier,
Wm. H. Leupp,
Edmund J. Levine,
G. Levor,
Louis S. Levy,
Adolph Lewisohn,
Miss Alice Lewisohn,
Paul Lichtenstein,
E. K. Lincoln,
Frederick J. Lisman,
Lucius N. Littauer,
Mrs. John R. Livermore,
Miss Anna P. Livingston,
Mrs. Francis G. Lloyd,
Mrs. I. Ferris Lockwood,
Frank J. Logan,
Russell H. Loines,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Miss Carlotta R. Lowell,
August Lueder,
Walther Luttgen,
Mrs. N. H. Luttrell,
William M. Lybrand,
J. M. Richardson Lyeth,
S. Ma,
Mrs. C. B. Macdonald,
Clarence H. Mackay,
Kenneth K. Mackenzie,
Mrs. Charles F. MacLean,
Malcolm MacMartin,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
Chas. Mallory,
Thomas L. Manson,
Miss Delia W. Marble,
John Markle,
Mrs. John Markle,
Dr. J. W. Markoe,
Otto Maron,
Mrs. Henry Marquand,
Edwin S. Marston,

Dr. Walton Martin,
William J. Matheson,
Robert Maxwell,
Harry Mayer,
Mrs. R. de L. Mayer,
Dr. D. H. McAlpin,
Geo. L. McAlpin,
George McAneny,
Henry P. McKenney,
John A. McKim,
James McLean,
Edward F. McManus,
William McNair,
B. Frank Mebane,
Morton H. Meinhard,
Dr. Walter Mendleson,
Herman W. Merkel,
John L. Merrill,
Manton B. Metcalfe,
Herman A. Metz,
Eugene Meyer, Jr.,
George A. Meyer,
Harry J. Meyer,
John G. Milburn,
Dr. Adelaide Mills,
Mrs. John Murray Mitchell,
Barrington Moore,
Clement Moore,
J. C. Moore,
Miss Katherine T. Moore,
H. de La Montagne,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P. Morgan, Jr.
Wm. Fellows Morgan,
Mrs. Pierpont Morgan,
Mrs. Cora Morris,
Mrs. Dave Hennen Morris,
Dwight W. Morrow,

Henry C. Mott,
Mrs. John B. Mott,
Frank J. Muhlfeld,
Carl Muller,
Rev. Joseph A. Mulry, S. J.,
John P. Munn,
Frank A. Munsey,
William S. Myers,
A. G. Nesbitt,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
William H. Nichols,
Wm. Nilsson,
George Notman,
Howard Notman,
Adolph S. Ochs,
John Offerman,
P. M. Ohmeis,
E. E. Olcott,
Elam Ward Olney,
Robert Olyphant,
Mrs. Emerson Opdycke,
Mrs. Wm. Openhym,
William C. Orr,
Prof. Henry F. Osborn,
Mrs. William Church Osborn,
Joseph Osler,
Miss Elizabeth H. Packard,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish, Jr.,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Miss Gertrude Parsons,
Mrs. Henry Parsons,

W. A. Paton,
Mrs. Frederick Pearson,
Charles E. Peck,
Dr. Charles H. Peck,
Mrs. Wheeler H. Peckham,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
Edmund Penfold,
Mrs. William A. Perry,
Samuel T. Peters,
Mrs. Theodore Peters,
W. R. Peters,
Carl Schurz Petrasch,
Curt G. Pfeiffer,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Carl Pickhardt,
Gottfried Piel,
Henry Clay Pierce,
Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
Edward Plaut,
Gilbert M. Plympton,
Bernard Pollak,
Chas. Lane Poor,
Mrs. James Harper Poor,
James E. Pope,
Alexander J. Porter,
Abram S. Post,
Miss Blanche Potter,
Frederick Potter,
Mrs. George D. Pratt,
Mrs. Herbert Lee Pratt,
John T. Pratt,
Mrs. L. B. Preston,
R. B. Price,
Miss Cornelia Prime,
Thomas R. Proctor,
Mrs. Kate Davis Pulitzer,
H. St. Clair Putnam,
Miss Eva C. Putney,
Percy R. Pyne,
Charles F. Quincy,
Charles Raht,
Edmund D. Randolph,
Stanley Ranger,
G. B. Raymond,
Mrs. William A. Read,
Miss Emily Redmond,
Geraldyn Redmond,
John Reid,
Geo. N. Reinhardt,
Chas. Remsen,
Howard Price Renshaw,
Miss Elvine Richard,
Oscar L. Richard,
Eben Richards,
E. O. Richards,
Wm. J. Riker,
Dr. Wm. C. Rives,
Miss Emeline Roach,
G. Theo. Roberts,
Miss Mary M. Roberts,
Miss Jennette Robertson,
Louis J. Robertson,
Andrew J. Robinson,
William G. Rockefeller,
Edward L. Rogers,
Miss Harriette Rogers,
Hubert E. Rogers,
A. J. Rolle,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Henry C. Ross,
Jacob Rossbach,
C. H. Ruddock,

Louis Ruhl,
Jacob Ruppert,
Miss M. L. Russell,
John Barry Ryan,
Arthur Ryle,
Harry Sachs,
Samuel Sachs,
Clarence Sackett,
Daniel C. Sands,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
Hermann Schaaf,
Fred'k Müller Schall,
George E. Schanck,
John Scheepers,
Anton Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Charles A. Schieren,
Gustave H. Schiff,
Rudolph E. Schirmer,
C. P. Schlicke,
Miss Jane E. Schmelzel,
Fedor Schmidt,
D. Schnakenberg,
Henrich Schniewind, Jr.,
Louis B. Schram,
Henry Schreiter,
B. Schutz,
C. M. Schwab,
Gustav Schwab, Jr.,
Walter Scott,
Miss Grace Scoville,
Robert Scoville,
The Scoville School,
Mrs. Arthur H. Scribner,
Edward M. Scudder,
Alonzo B. See,
Charles E. Seitz,
Prof. Edwin R. A. Seligman,
Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,
Alfred Seton,
Mrs. William F. Sheehan,
George R. Sheldon,
Finley J. Shepard,
James Shewan,
Wm. Shillaber,
Alfred L. Simon,
John W. Simpson,
Francis Louis Slade,
Ralph E. Slaven,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Miss Fanny A. Smith,
Frank Morse Smith,
Pierre J. Smith,
R. A. C. Smith,
William Graves Smith,
E. G. Snow,
Mrs. Charlotte Sorchan,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
J. R. Stanton,
Mrs. Mary P. Eno Steffanson,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Benjamin Stern,
Sereno Stetson,
Mrs. Byam K. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Lispenard Stewart,
Wm. R. Stewart,

Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
Mrs. Willard Straight,
H. Grant Straus,
Roger W. Straus,
Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
Edward W. Strobhar,
Mrs. Gustaf Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Mrs. Theron G. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
E. H. T. Talmage,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
C. H. Tenney,
H. L. Terrell,
Mrs. John T. Terry,
Thomas Thacher,
Miss M. J. Thayer,
Mrs. Hector W. Thomas,
Mrs. Howard L. Thomas,
Percival Thomas,
Seth E. Thomas, Jr.,
L. S. Thompson,
Lewis M. Thompson,
Loren Ogden Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
James Timpson,
Mrs. Margaret T. Tjader,
J. Kennedy Tod,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
E. S. Twining,
Lucien H. Tyng,
Oswald W. Uhl,
Theodore N. Vail,
James J. Van Alen,
Mrs. Frederick T. Van Beuren,
Barend Van Gerbig,
E. H. Van Ingen,
Mrs. Warner M. Van Norden,
Edgar B. Van Winkle,
Hon. Robert A. Van Wyck,
Mrs. Wilbur Linwood Varian,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Alfonso P. Villa,
Mrs. Gustavus A. Walker,
James N. Wallace,
Leo Wallerstein,
Dr. Max Wallerstein,
Wm. I. Walter,
Artemus Ward,
Mrs. John I. Waterbury,
C. W. Watson,

Thomas L. Watt,
Mrs. E. H. Weatherbee,
H. Walter Webb,
J. G. Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,
Charles H. Weigle,
Bernard Weinig,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Oliver J. Wells,
Arthur L. Wessell,
Dr. William West,
William Young Westervelt,
Miss Edith Wetmore,
Mrs. Alice T. Wheelock,
Dr. Wm. E. Wheelock,
Miss Caroline White,
Mrs. Stanford White,
Clarence Whitman,
Miss Margaret S. Whitney,
Edward A. Wickes,
Elmore A. Willets,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
James R. Williston,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Miss Margaret B. Wilson,
M. Orme Wilson,
Bronson Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Lewis S. Wolff,
William E. Wolff,
Prof. R. S. Woodward,
Miss Julia Wray,
Mrs. J. Hood Wright,
Mrs. A. Murray Young,
Joseph A. Zanetti,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. Charles D. Dickey,
Mrs. Walter Jennings,
Mrs. Delancey Kane,
Mrs. Hamilton F. Kean,
Mrs. A. A. Low,
Mrs. Charles Mac Veagh,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Mrs. George D. Pratt,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Benson B. Sloan,
Mrs. Theron G. Strong,
Mrs. Henry O. Taylor,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

New York, January 13, 1919

To the Board of Managers of the New York Botanical Garden.

Gentlemen: Herewith I submit a statement of my Receipts and Disbursements during the year 1918, and Balance Sheet from my Ledger as of December 31, 1918.

Respectfully submitted,

John L. Merrill,
Treasurer.

Receipts and Disbursements

Receipts

Balance from Annual Report of 1917		$ 35,156.42
Investment Guggenheim Greenhouse Fund		
Sale of $45,000. New York Central Railroad Company Two Year 5% Coll. Gold Notes	$ 44,521.88	
Life Membership Fees Credited to Endowment Fund	250.00	
Contributions from New York City towards Maintenance	105,759.11	
Other contributions		
To Students Research Fund	121.00	
To Garden School Fund	4,148.66	
To Emergency Fund	5,300.00	
To School Garden Summer House Fund	30.00	
To Special Fund for Books	47.09	
Refund, credited to Convention Garden Fund	.13	
Annual Dues	8,570.00	
Fellowship Members Fees	200.00	
Sustaining Members Fees	350.00	
Subscriptions to "Addisonia" credited to Income of Addison Brown Fund	2,435.00	

Subscriptions to "North American Flora," Sales of Publications, credited to Income of David Lydig Fund	2,056.19
Plant Fund	563.75
Sundry Sales, credited to Income of Stokes Fund	2.28
Sales of paper, credited to General Income	1.00
Sale of plates, credited to Income of Addison Brown Fund	.80
Sales credited Chas. B. Robinson Fund	21.55
Liberty Loan Subscriptions made for account of employees	
Repayment by employees	9,470.00
Income from General Investments credited to General Income Account	
5% on $50,000. Southern Ry. 1st Consolidated Mortgage Bonds $2,500.00	
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds	2,250.00
4% on $50,000 Erie Railroad Co. Prior Lien Bonds	2,000.00
4% on $59,000 Erie Railroad Co. Penn. Coll. Trust Bonds	2,360.00
4% on $50,000 Reading R. R. Co. Bonds, Jersey Central Coll. Tr.	2,000.00
4% on $24,000 Northern Pac. R. R. St. Paul, Duluth Divn.	960.00
4% on $35,000 Northern Pac. R. R. Bonds, Gt. Nor. C. B. & Q. Trust	1,400.00
5% on $10,000 Louisville & Nash. R. R. Eqpt. Notes	500.00

4% on $10,000 New York City Stock due 1959....	400.00	
4½% on $10,000 N. Y. Cent. Lines Eqpt. Notes	450.00	
4% on $11,000 Milwaukee, Sparta & No. West. R. R. Bonds.....	440.00	
4½% on $50,000 Pennsylvania R. R. Genl. Mtge. Bonds.....	2,250.00	
5% on $10,000 Balto. & Ohio R. R. Bonds.....	500.00	
5% on $50,000 Great Nor. R. R. Coll. Trust Gold Notes.....	2,500.00	20,510.00
Income from Investment of John Innes Kane Fund, 5% on $10,000 Great Northern Railway Co.....		500.00
Income from Investment of Maria DeWitt Jesup Fund,		
4% on $15,000 No. Pac. Prior Lien.....	$ 600.00	
4¼% on $10,000 Liberty Loan Bds. Sept. 1, 1918..	148.98	748.98
Income from Investment of Addison Brown Fund,		
4% on $22,000 Nor. Pac. Prior Lien Bds.....		880.00
Income from Investment of Guggenheim Greenhouse Fund, N. Y. Central 2 yr. Notes.....		3,994.45
Interest on Liberty Bonds held by Garden, not paid for by employees...	30.00	
Interest account, being interest at 3% on balances deposited with Messrs. J. P. Morgan and Company for the year 1918 (credited to General Income Account).....	614.12	
	$211,125.99	$211,125.99
		$246,282.41

Disbursements

Investments

Account Maria De Witt Jesup Fund		
Third Liberty Loan Bonds $10,000		$10,000.00
Allowance Director-in-Chief		
Increased appropriation to Director-in-Chief for working fund.....	5,000.00	$ 15,000.00
Expenses paid Through Director-in-Chief		
Account of New York City appropriations.....	$105,759.11	
General account for vouchers paid..	26,455.36	
Garden School Fund.....	1,791.53	
Guggenheim Greenhouse Fund.....	41,772.08	
School, Garden Summer House Fund	2,283.50	
Emergency Fund.....	5,861.25	
Special Fund for books.....	63.69	
Plant Fund for purchase of plants...	487.72	
Publications, debited to Income of David Lydig Fund.....	1,482.64	
Sundries, debited to Income of D. O. Mills Fund.....	1,400.86	
Printing, debited to Income of Stokes Fund.....	26.55	
Income of Science and Education Fund.....	3,938.08	
Income of Students Research Fund	100.00	
Income of Henry Iden Fund.....	475.00	
Income of William R. Sands Fund..	461.00	
Income of John Innes Kane Fund ..	476.72	
Income of Maria DeWitt Jesup Fund..	899.49	
Income of Addison Brown Fund....	3,953.22	
Income of C. B. Robinson Fund....	50.00	$197,737.80
Sundry Accounts		
Subscription to Third Liberty Loan, for account of Garden employees .	$ 3,300.00	
Subscription to Fourth Liberty Loan, for account of Garden employees .	4,400.00	7,700.00
		$220,437.80

Balance, Cash in hands of Treasurer (on deposit with J. P. Morgan and Co.)	25,844.61
	$246,282.41

Ledger Balances, December 31, 1918

Credit

Permanent Funds

Endowment Fund	$306,260.00
Endowment Fund, for Science & Education	83,461.90
David Lydig Fund, Bequest of Charles P. Daly	34,337.86
Legacy of Wm. R. Sands	10,000.00
Darius Ogden Mills Fund	50,000.00
Henry Iden Legacy	10,000.00
Addison Brown Legacy	21,850.00
John Innes Kane Fund	10,000.00
Stokes Fund	3,000.00
Charles Budd Robinson Memorial Fund	673.85
Maria DeWitt Jesup Legacy	25,000.00
Students Research Fund	4,124.00
	$558,707.61

Temporary Funds

Guggenheim Greenhouse Fund	$ 54,175.02
Rose Garden and Garden Extension Fund	13.85
Garden School Fund	3,332.07
Emergency Fund	1,044.84
School Garden Summerhouse Fund	124.50
Income Students Research Fund	415.45
Income John Innes Kane Fund	60.13
Income Addison Brown Fund	1,423.60
Income Charles Budd Robinson Fund	28.53
Special Fund for Books	135.24
Income David Lydig Fund	475.61
Income Stokes Fund	4.74
Interest on Liberty Loan Bonds (not taken up by employees)	30.00
Plant Fund	542.35

Exploration Fund	24.05
Museum and Herbarium Fund	26.08
	$ 61,856.06
Grand total	$620,563.67

Debit

General Investments

$50,000	Ches. & Ohio Genl. Mtg. Bonds	$312,424.18
50,000	So. Ry. Co. 1st Cons. Mtg. Bds.	
50,000	Erie R. R. Co. Prior Lien Bds.	
59,000	Erie R. R. Co. Penn. Coll. Tr. Bds.	
50,000	Reading R. R. Co. J. C. Coll. Tr. Bds.	
24,000	Nor. Pac. R. R.-St. P. & D. Div. Bds.	
30,000	Nor. Pac. Gt. Nor.-C. B. & Q. Coll.	
10,000	N. Y. City 4% Stock 1959	

Investment, D. O. Mills Fund

$50,000	Penn. R. R. Genl. Mtg. Bonds, 4½%	$ 50,418.33

Investment, Science & Education Fund

$10,000	N. Y. Cent. Lines Eqpt.	$ 84,532.36
10,000	Louisville & Nashville Eqpt.	
10,000	Balto. & Ohio Refunding Genl. Mtg. Bds. due Dec. 1995, 5%	
5,000	Chic. Burlington & Quincy R. R. Jt. 4s. July 1, 1921	
50,000	Gt. Nor. Rwy. 5% Gold Notes due Sept. 1, 1920	

Investment, Henry Iden Fund

$11,000	Milwaukee, Sparta & No. W. R. R. Bonds.	10,120.00

Investment, Addison Brown Legacy

$22,000	Nor. Pac. Prior Lien Bds. 4%	21,380.69

Investment, John Innes Kane Fund

$10,000	Gt. Northern Rwy. Co. 5% Gold Notes due Sept. 1, 1920	10,015.62

Investment, Maria De Witt Jesup Fund

$15,000	No. Pac. Prior Lien Bonds, 4%	23,378.75
$10,000	Liberty Bonds, Third Loan.	

Investment, Guggenheim Greenhouse

$30,000	N. Y. Central Lines, 1919	28,228.12

Income from Investment Maria De Witt Jesup Fund.	134.96
Director-in-Chief Working Fund.....	30,000.00
General Income Account	
Balance borrowed from Permanent Funds.....	21,931.05
Liberty Loan Account	
Due by employees.....	2,155.00
Cash in Hands of Treasurer	
Jan. 1, 1919 (on deposit with J. P. Morgan & Co.)	25,844.61
	$620,563.67

REPORT OF THE SPECIAL AUDITOR

Treasurer's Account for the Year 1918

Room 3111, Grand Central Terminal
New York, March 19, 1919

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and eighteen (1918), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

I have also examined the various investment securities and find the same to be as reported in the said balance sheet.

Respectfully submitted,

A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1918

Room 3111, Grand Central Terminal
New York, March 19, 1919

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and eighteen (1918), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

Respectfully submitted,
A. W. Stone,
Special Auditor.

APPROACH TO ELEVATED RAILWAY STATION

BULLETIN
OF
The New York Botanical Garden

Vol. 10 No. 38

DESCRIPTIVE GUIDE TO THE GROUNDS, BUILDINGS, AND COLLECTIONS

Fourth Edition*

Location

The New York Botanical Garden is situated in the northern part of Bronx Park, north of Pelham Avenue, the reservation including nearly 400 acres of land of a very diversified character, furnishing natural landscapes of great beauty and variety.

Means of Access

The Garden is conveniently reached in the following ways:

1. By the Harlem Division of the New York Central and Hudson River Railroad to The Botanical Garden Station.

2. By the Third Avenue Elevated Railway system to the terminal station of that road at Bronx Park.

3. By the Subway, Lenox Avenue and West Farms branch, with transfer at 149th Street and Third Avenue to Elevated Railway, thence to Bronx Park Station, or by the White Plains Avenue Extension of the Subway from East 180th Street to stations at Pelham Parkway and Allerton Avenue.

4. By trolley car on Webster Avenue to 200th Street or the Woodlawn Road. This line connects with lines from

* For first edition see Bulletin no. 16; for second edition see Bulletin no. 23; for third edition see Bulletin no. 34.

the western part of The Bronx on Fordham Road, and on Tremont Avenue, and also with the line to Yonkers.

5. By trolley car on the White Plains Road east of Bronx Park from West Farms, Williamsbridge, and Mt. Vernon, connecting with lines from the eastern part of The Bronx at West Farms and at Mt. Vernon.

6. By trolley car, on the Southern Boulevard to Pelham Avenue. This line connects with lines from the southern and southeastern parts of The Bronx.

7. By driveways in Mosholu Parkway from Van Cortlandt Park; from Pelham Bay Park through Pelham Parkway; through the Crotona Parkway and Southern Boulevard from Crotona Park; there are also driveway entrances at 200th Street, convenient for motor-cars coming from Jerome Avenue; at Bronx River Parkway, at the northern end of the Garden, for motor-cars coming from the north; at Allerton Avenue on the eastern side of the Garden for motor-cars coming from the east; and at the Woodlawn Road, convenient for motor-cars coming from Yonkers, and from other points west and northwest of the Garden; there are three driveway entrances from Pelham Avenue.

Purposes

The New York Botanical Garden was established by an Act of the Legislature of the State of New York passed in 1891 and amended in 1894 "for the purpose of establishing and maintaining a Botanical Garden and Museum and Arboretum therein, for the collection and culture of plants, flowers, shrubs and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people."

NEW YORK CENTRAL RAILROAD STATION

General Plan

A. Buildings

The principal buildings open to the public are:

1. The largest botanical museum building in the world, located near the Botanical Garden Station of the New York Central Railroad and the Mosholu Parkway entrance. This building includes, in addition to the museum exhibits on the main floors, a large lecture hall for public lectures in the basement; and the library, laboratories for instruction and research, and the herbarium, on the upper floor.

2. Conservatory range 1, a large and handsome glass-house located near the Elevated Railway Station and containing plants from tropical regions.

3. Conservatory range 2, a similar building more than half finished, situated on the eastern side of the Garden near the Allerton Avenue entrance.

4. The mansion, a stone house built by the Lorillard family in 1856, stands on the east side of the Bronx River, above the waterfall. It contains meeting rooms, board rooms, horticultural laboratories, a lecture room, the oellections of the Bronx Society of Arts and Sciences, the office of the Secretary of the Horticultural Society of New York, and the shops of the Garden, which are in its basement.

B. Systematic Plantations

Containing plants arranged in botanical sequence for comparative study.

5. The pinetum, or collection of cone-bearing trees, mostly evergreens, brought together on the hills and slopes on all sides of conservatory range 1, and in the space bctween that structure and the museum building.

The young white pine, red pine, and white fir plantations are located south of the herbaceous garden, near the Victory Grove of Douglas spruce trees.

6. The deciduous arboretum, or collection of trees which

lose their leaves in the autumn, located along nearly the entire eastern side of the grounds from Pelham Avenue to Williamsbridge.

The salicetum, or collection of willows, occupies several acres on both sides of the river at the north end of the grounds.

7. The fruticetum, or collection of hardy shrubs, located on the plain northeast of the museum building at the Woodlawn Road entrance and extending northward into the north meadows; this collection is also arranged by botanical relationship.

The viticetum, or collection of shrubby vines, is in the edge of the forest east of the economic garden, not far from the museum building.

8. The herbaceous garden, situated in the valley east of conservatory range 1, near the Southern Boulevard entrance, containing collections of hardy herbaceous plants arranged by botanical relationship.

9. The morphological garden, just north of the herbaceous garden, designed to illustrate forms of plants and plant structures studied in elementary botany.

10. The economic garden, adjoining the morphological garden on the north, containing groups of hardy plants whose products are directly useful to man.

C. Horticultural Plantations

Containing plants that may be used for decorative purposes. The systematic plantations also contain a number of such plants.

11. Decorative woody plants in groups along the roads and paths and in various parts of the grounds, consisting of conifers, rhododendrons, flowering shrubs, magnolias, etc.

12. The Japanese cherry collection, in the valley between the river and conservatory range 2, containing over a hundred trees that flower every spring.

13. The rose garden, an area of over an acre located in

the valley west of Long Lake and not far from the Pelham Parkway Station of the Subway. Several hundred varieties of the finest roses are in bloom there from early summer to autumn.

14. The lilac garden, situated south of the rose garden on Pelham Parkway and containing a good representation of single- and double-flowered varieties.

15. Flower gardens containing a great variety of plants in bloom from early spring to late autumn. These are chiefly located in the vicinity of conservatory range 1 and the Elevated Railway Station.

16. Horticultural collections, situated south of the herbaceous garden and containing collections of cannas, phloxes, gladioli, rose mallows, and plants having variegated or colored foliage.

17. The dahlia collection, in the west border north of the Harlem Railway Station, containing several hundred of the best varieties to be obtained.

18. The iris collection, or iris garden, situated in the extreme southwestern corner of the grounds where Pelham Parkway and the Southern Boulevard meet.

19. The water garden, northeast of the museum building, containing water-lilies and other aquatic plants.

D. Natural Features

In addition to these artificial features, the following natural features are noteworthy:

20. The hemlock forest, a grove of the Canadian hemlock spruce, clothing the hills between the museum building and the Bronx River and covering about forty acres, considerable portions of it being primeval.

21. The gorge of the Bronx River, extending south from the waterfall at the Mansion, along the edge of the hemlock grove. The river plunges through its gorge in a series of rapids passing into quiet waters before it leaves the Garden under the Linnaean Bridge.

22. The north meadows and river woods along the Bronx

River from the northern end of the hemlock grove to the northern end of the Garden.

23. Deciduous woodlands on rocky ridges in the southern and central parts of the reservation.

E. Park Features

24. Entrances.
25. Roads and paths.
26. Bridges.
27. Water supply and drainage.
28. Shade trees and border screens.
29. Shelters and pergolas.

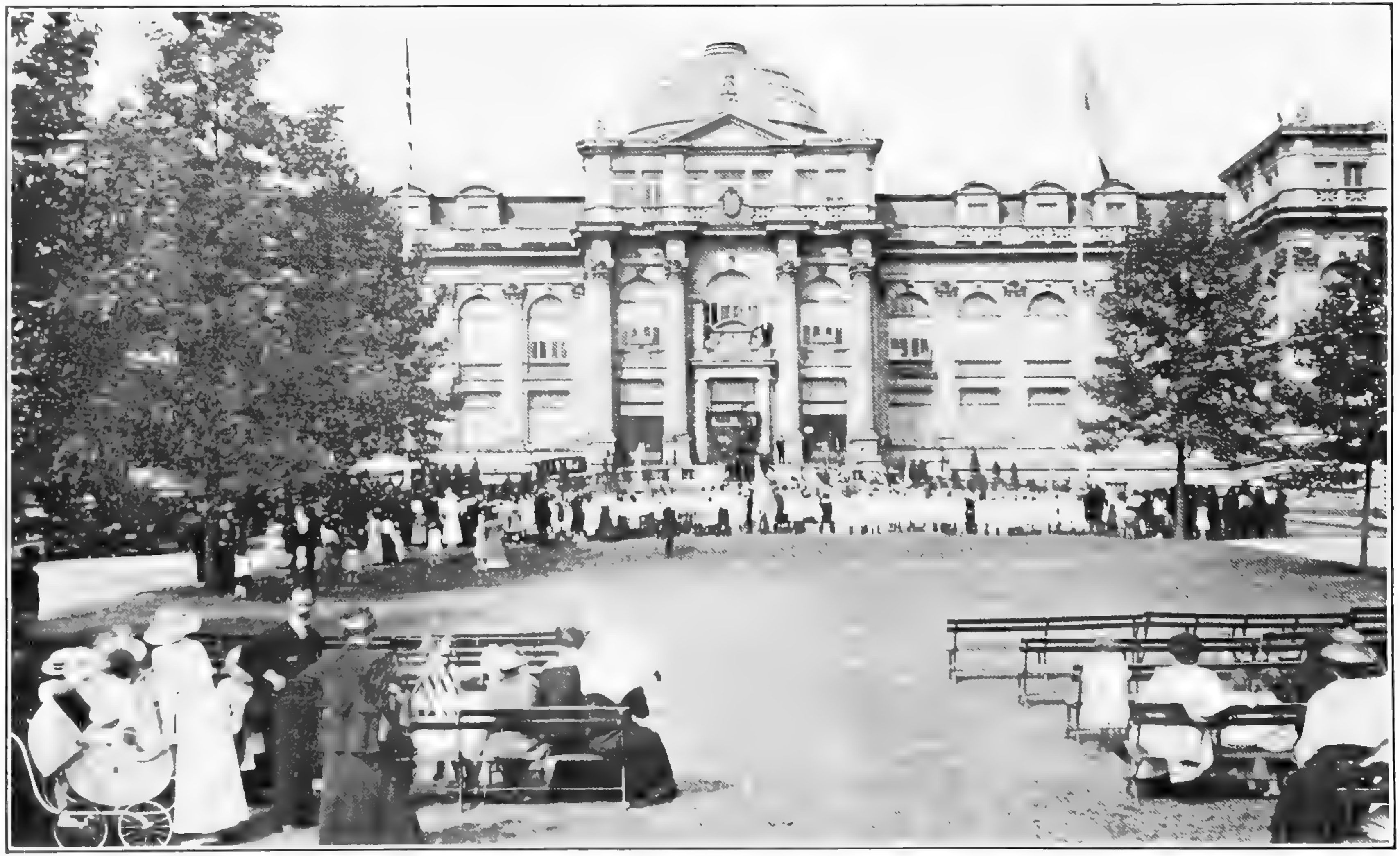
1. The Botanical Museum

The Museum Building has a frontage of 312 feet, and in so far as now constructed, a depth of about 90 feet; the plan of this building contemplates its future extension toward the rear, so as to form a quadrangle enclosing a court. The architectural style of the building is Italian Renaissance. The walls are of light-colored brick and the trimmings of terra-cotta. It has a steel frame and concrete floors. Three floors are devoted to public exhibits, while the upper floor contains study rooms, the library, laboratories and herbarium, which may be used and consulted by permission.

The building is approached by two straight driveways and accompanying sidewalks leading from the main park driveway near the New York Central Railroad station; this front approach to the building is ornamented by a bronze fountain executed by the sculptor Carl E. Tefft, and by terra-cotta fountains and marble seats designed by R. W. Gibson, the architect of the building. The lofty steel flag-poles were donated by Mr. Edward D. Adams. The vista lines are formed by four parallel rows of tulip-trees.

The public collections in this building are:

THE MUSEUM BUILDING AND APPROACHES



MAIN ENTRANCE OF MUSEUM BUILDING

1. THE MUSEUM OF ECONOMIC BOTANY*

This occupies the entire main floor, and comprises both crude and refined products of plants used in the arts, the sciences, and the industries, as well as illustrative photographs and drawings. The specimens, at present totaling nearly 10,000, are classified primarily as products, including foods, drugs, fibers, gums, resins, sugars, rubbers, spices and flavoring-agents, dye-stuffs, tanning-materials, plant-constituents, fixed- and volatile-oils, cork, starches, and others as indicated by the accompanying floor plan. The articles pertaining to each of these primary classes are then arranged in their botanical sequence, proceeding from the lower to the higher plants.

The arrangement of the larger groups is as follows: Foods and fibers occupy the west hall, the former in cases on the north side, the latter on the south. The west wing is mainly given over to exhibits other than foods, fibers, drugs, and woods. The east hall contains the drugs, while to the east wing are assigned woods and wood-products, and a collection illustrating North American dendrology. Not all of the cases are as yet in place, additions being installed from time to time, as the growth of the Museum requires. In the following numbering, allowance is made for such additions.

Fibers. Cases 1 to 30.—In the first case of the series devoted to fibers may be found cotton, now the most important of the vegetable hairs and fibers. It is derived from the fruit of the cotton plant (*Gossypium*), being the hairs that cover the surface of the seeds. The fruits from several different kinds of cotton-plants may be seen with the cotton bursting from the capsule, while some of the many different products are also shown.

The fiber of other plants, derived from leaves, stem, bark, roots, and other organs, is of great economic importance and is used, either in practically its natural condition, as

* For more detailed information, see our Guide to the Economic Museum.

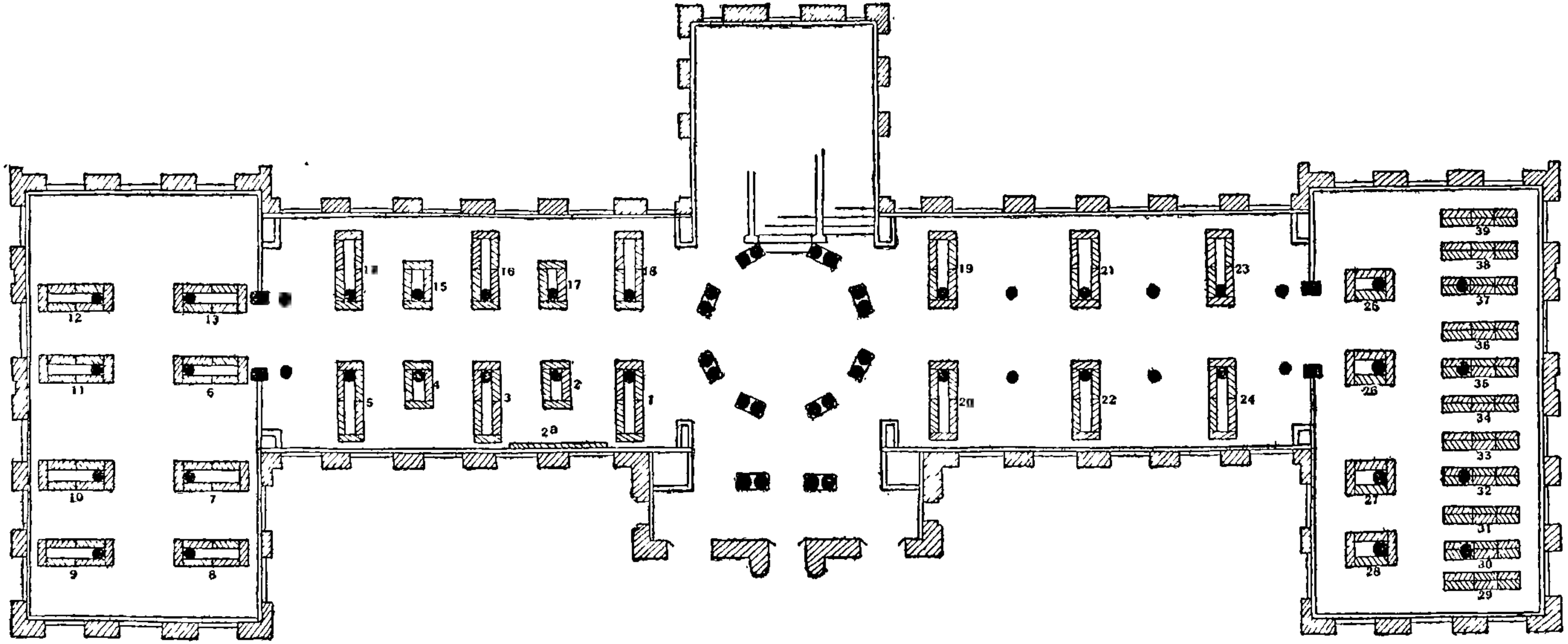
may be seen by the specimens of fans, hats, boxes, bags, baskets, mats, matting, crude ropes, brooms, ornaments, and toys; or it is manufactured into articles of commerce after processes which remove it considerably from its natural aspect or condition; for example, linen, which is made from the flax plant; cloth, twine, and rope, made from jute, hemp and abutilon-fiber; and paper made from wood and other fibers.

Cork and its Products. Case 34.—This exhibit comprises the crude cork bark and specimens illustrating its preparation for the cutting of corks; also a large number of articles illustrating its uses. Cork forms the outer portion of the bark of most woody stems. That of one species of oak, *Quercus Suber*, of the Mediterranean region, possesses peculiar properties of toughness, elasticity, and imperviousness to liquids and vapors, which make it useful for bottle stoppers. Many attempts have been made to find substitutes, but none have been found to possess an equal value. It has many other important uses. After removal from the tree, and the shaving off of its gray outer layer, it is alternately beaten with mallets and heated, to close up the natural fissures. Its removal does not injure the tree, since it will split off periodically if not removed.

The cutting of cork requires extremely sharp instruments, operated by machinery running at a high rate of speed. The substance, as we are accustomed to see it, is prepared by means of boiling the cork bark and scraping off the rough outer portion. A large jacket of crude cork is exhibited near by, just as it was stripped from the tree.

Paper Pulp and Paper. Cases 35 and 36.—Wood sections used for paper pulp, and the various stages in the manufacture of the latter are illustrated, as well as a number of varieties of paper made from such pulp.

Wood fiber, especially that obtained from the trunks of the spruce and poplar, enters largely into the manufacture of paper. In cases 35 and 36, the fiber is shown in its crude condition and in the various stages of refinement,



FLOOR PLAN, MUSEUM OF ECONOMIC BOTANY

1–5. Cases 1–30. Fibers
6. Case 34. Cork and its products
Cases 33–36. Paper pulp
Cases 37–39. Rubber and allied products
7. Cases 40–42. Varnish resins
Cases 43–44. Miscellaneous resins
Case 45. Dye stuffs
8. Cases 46–47. Tanning materials
Cases 48–51. Flavoring agents, spices, and condiments
9. Case 52. Waxes
Case 53. Fixed oils or fats
Case 54. Soap and soap-substitutes
Cases 55–57. Volatile oils or essential oils
10. Case 58. Volatile oils or essential oils
Cases 59–60. Perfumery
Cases 61–63. Fumitories and masticatories
11. Case 64. Fumitories and masticatories
Cases 65–69. Beverages, including chocolate
12. Cases 70–75. Proximate principles or plant constituents
13. Case 76. Starches
Cases 77–78. Sugars
Cases 79–81. Fodder plants
14–18. Cases 85–114. Human foods
19–24. Cases 115–174. Drugs, including poisonous plants and insecticides
25–28. Cases 181–195. Woods and wood products
Case 196. Charcoal
Case 197. Miscellaneous specimens
29–39. Cases 199–264. North American Dendrology

as well as the various qualities of paper into the structure of which it enters. Here also are specimens of straw and other specimens illustrating the several stages and substances connected with the production of straw paper.

Rubber and Allied Products. Cases 37–39.—The first case in the west wing contains rubber and allied products. Here are the implements and utensils used in collecting the rubber "milk" from the trees which grow in tropical forests. Rubber is derived mostly from trees belonging to the mulberry family, spurge family, and dogbane family. Rubber, India-rubber, or elastic consists chiefly of the peculiar substance caoutchouc, which, in the form of an emulsion, constitutes the milky juices of many plants, existing in special milk-tubes of the bark and wood. The bark is cut or punctured, when the milk exudes and is caught in some receptacle. The milk is coagulated by various methods, mostly by subjecting it to the action of smoke, and the coagulated mass, after losing water by slow evaporation, takes on the dark color, toughness, and elasticity characteristic of rubber. Rubber is more valuable in proportion as its percentage of caoutchouc is greater, and that of its resin less. The most important source of rubber is the tree *Hevea brasiliensis*, the Para Rubber tree, native of Brazil, now very extensively planted in the East Indies.

Several varieties of rubber may be seen in the different stages of refinement, together with some articles as manufactured for the market. Here, too, are two allied products, gutta-percha and balata, which are derived from the trunks and foliage of certain trees belonging to the sapodilla family. These trees grow in many portions of the tropics.

Varnish Resins. Cases 40–42.—The varnish resins proper are mostly dug from the earth, where they have laid imbedded for ages in a sort of fossil state. Their value for varnish purposes is due to the fact that they dissolve with great difficulty, thus possessing the quality

of permanence and durability; also that they are very hard, for which reason they take and retain a high polish. Many resins of recent production and of less value, are added to the cheaper varieties of varnish. Our collection contains representatives of practically all varnish resins that are in use.

Miscellaneous Resins. Cases 43 and 44.—Resins are waste substances produced by the life processes of the plant. They are transported through the plant body in a liquid state, being dissolved, mostly in volatile oils. When the ducts or cavities containing them are broken or cut, they exude upon the surface and may then harden by the evaporation of the oil. They are collected for use by various methods, some of which are illustrated by the specimens and pictures exhibited in the cases.

Dye Stuffs. Case 45.—Many of the substances produced by the living plant and stored in its body possess colors which can be imparted to fabrics or other articles immersed in their solutions. There are others which, although themselves not colored originally, yield useful dyes when some chemical agent is added to them. All such plant substances, as well as the vegetable tissues containing them, are known as "dye stuffs." Good illustrations are logwood, brazil-wood, madder, alkanet, and indigo, besides which, many of less importance are to be seen in our collection.

Although the use of anilin or coal-tar colors has very largely replaced that of vegetable dyes, there is still a vast use of the latter. But for the introduction of the former, it is difficult to see how the demand for colors could have been supplied under modern conditions.

Tanning Materials. Cases 46 and 47.—The tanning materials are also very important from an economic standpoint. They depend for their value chiefly upon the tannic acid that they contain, but that other constituents contribute is clear from the fact that a substance containing less tannin may be more valuable than one containing a

larger percentage. The tannin cures and toughens the skin, but other effects are required to produce the best quality of leather, especially that of "filling" the minute cavities. For this purpose, white-oak bark seems to be preeminent and this continues to be the most valued tanning substance. It has become scarce and costly, and "oak leather" now brings the highest prices. The tannins are represented by saw-palmetto, mangrove, pine, hemlock, sumac and by other products. The crude materials of the mangrove and the saw-palmetto are accompanied by their fluid extracts, which contain the tannic acid, and also by the spent material or refuse which remains after the extract has been made. This latter material may be used for other purposes.

Flavoring Agents, Spices, and Condiments. Cases 48–51. —The term "flavoring agent" is applied to any substance used to impart an added agreeable flavor to anything intended to be taken into the stomach through the mouth, or to remove or cover a disagreeable flavor in such a substance, as for instance a disagreeable medicine. The term "spice" is applied to a flavoring agent which possesses an aromatic and more or less pungent quality, such as anise, caraway, or cinnamon. By the term "condiment" is usually understood one of the more powerful agents of the preceding group, such as pepper, capsicum, mustard, or horseradish. Condiments do something more than to impart a flavor to the food. They act strongly on the nerve of taste, stimulating it to a keener sense of the natural flavor of the food. They also tend to affect the appetite and, when properly used, often to increase the digestive activity. All of these groups are liberally represented in these cases.

Waxes. Case 52.—Waxes are plant exudations, related chemically to the oils. Although they are produced by many plants, this product is usually so small that their collection is not practicable. In this way, they exist upon the surface of such fruits as grapes, plums, and some

varieties of pumpkin, appearing as a thin whitish coating, commonly called the "bloom." In the same way they occur upon the surface of many leaves. The term *glaucous* is applied in descriptive botany to such surfaces. In a few cases, wax exudes in such quantity as to be collectable in commercial quantity. This is usually done by placing the wax covered tissue in hot water, when the wax is melted and may be skimmed off of the surface of the water. A good illustration of this wax is that found upon the surface of the bayberries, illustrated in our collection.

Fixed Oils or Fats. Case 53.—Fat is a very abundant plant product, occurring more abundantly in ripe seeds than in other parts. Fats also often occur abundantly in the pericarps of fruits, especially those of the palm family. The best method of extracting oils is by a simple process of pressure, in the cold state. Such an oil, if the pressure be moderate, is likely to be quite pure. Pressure with heat is often employed, the yield of oil thus being increased. In many cases, oils are obtained by boiling the product in water, from the surface of which the extracted fat may be skimmed. In many cases, this method is liable to cause deterioration of the fat by its partial decomposition. Many oils, as those of coconut, cotton-seed, and olives, yield important food products. Many others, as linseed oil, are largely employed in paints, others in soap-making or for lubricating purposes. In other cases, as castor and croton oils, they are highly medicinal. There are vast numbers of oil-yielding products in tropical countries which are not collected, the annual wastage of such products running into enormous values.

Soap and Soap Substitutes. Case 54.—One of the most important uses of the fixed oils is for soap-making, and of the volatile oils, that of perfuming such soap. The manufacture of soap consists essentially in boiling the oil or fat with an alkali by which process the acid of the fat is caused to combine with the alkali, this product constituting soap. The glycerin of the fat is set free as a by-product.

Resins, being much like fats in their chemical nature, may be substituted for the fats, resulting in what are known as "resin soaps." In this case may be seen a series of products which illustrate the various steps in the soap-making process.

Many plants, such as soap-root and soap-bark, contain a peculiar substance called "saponin," which possesses the property of forming a lather with water, like soap. Although this is too irritating for general use upon the skin, it has great cleansing power and is largely employed as a soap substitute in the cleansing of fabrics, the removal of grease and for similar purposes. Many vegetable substances containing saponin are displayed in this case.

Volatile or Essential Oils. Cases 55–60.—These products are exceedingly numerous in the vegetable kingdom, being responsible for the fragrance of flowers and other parts of the plant, as well as for some odors which are exceedingly disagreeable to man. The volatile oils are stored in special cells or cavities and are extracted for human use in various ways, the most usual being that of distillation. This method consists in tightly packing the plant or plant part containing the oil, in a still, flooding with water and applying heat. A small quantity of the oil thus driven out of the plant-tissue is absorbed by the water. After the water has become saturated with the oil, the remainder of the latter passes off in the form of vapor, which is caught and condensed by cooling. In a few cases, as those of lemon and orange-peel oils, the oil is extracted by pressure. Volatile oils are usually rather expensive products, some of them, like attar of roses, possessing a very high money value. The following are some of the best known volatile oils. From roots are obtained the oils of lovage, elecampane, and muskroot; rootstocks or underground stems furnish the oils of calamus, ginger, orris-root, and wild ginger; herbage is the source of the oils of pennyroyal, tansy, spearmint, and peppermint; wood furnishes the material to make the oils of red-cedar

wood and sandalwood; bark is the source of the oils of birch, cinnamon, and sassafras; leaves yield the oils of hemlock, spruce, pine, cedar, eucalyptus, and wintergreen; flowers yield the oils of cloves, lilac-flower, and orange flowers; fruits yield the oils of pepper, lemon, caraway, and fennel; seeds furnish the oils of mustard, wormseed, nutmeg, and almonds; while resins give us the oils of elemi, mastic, myrrh, and frankincense.

Perfumery. The volatile oils described above are the principal substances used in the manufacture of perfumery. Very often the perfumes are made by merely dissolving one or more such oils in water, alcohol, or other substance capable of absorbing them. The oil-saturated water, produced in the distillation process described above, is itself used as a perfume. In other cases, layers of fresh fragrant flowers, as roses or violets, are pressed tightly between layers of lard or other fatty material, which absorbs the oil directly from the flowers and constitutes pomades. In some cases, oils having very offensive odors may have such odors completely changed into agreeable ones by combination with some other substance.

Fumitories and Masticatories. Cases 61–64.—The term "fumitory" is applied to any substance used for producing a smoke that is to serve some useful or desirable purpose. That now almost exclusively employed for smoking by human beings is tobacco, although various other substances are often added to the latter. A "masticatory" is a substance used for chewing. Tobacco is very largely employed as a masticatory also, but has in recent years been largely replaced by chewing gums of varying composition. In the chewing of these articles the chief or only object sought is that of exercising the jaws, but there are masticatories in use by the people of other countries which produce far more important effects. This is notably true of the coca-leaf, chewed by the natives of the South American Andes and producing very powerful and important physiological effects. Most of the important masticatories in use are shown in our collections.

Beverages, including Chocolate. Cases 65–69.—These are represented by both the alcoholic and non-alcoholic classes. Of the latter, one of the most important is pure or nearly pure drinking water obtainable from the hollow leaf-stems of the traveler's palm, from the stems of some tropical vines, from young cocoanuts, and some other plant parts. Other non-alcoholic beverages represented are tea, coffee, maté or Paraguay tea, and various fruit juices. Of the alcoholic group, malt liquors, such as beer and ale, many wines and distilled liquors are shown. In our Guide to the Economic Museum may be found suitable references to the origin and manufacture of these beverages and to their special effects on the human system.

Proximate Principles or Plant Constituents. Cases 70–75.—These cases contain the most valuable, as well as the most instructive set of collections in our Museum. A "proximate principle" of a plant, or animal, is any substance having a definite and fixed chemical composition as it exists naturally in the living body. As illustrations of such substances, we may mention starch, sugar, cellulose, saponin, castor-oil, and quinine. It will be noted that they represent nutrient as well as medicinal substances. In fact, it is the proximate principles of plants which give to them any useful properties that they possess when absorbed into the human system. When any vegetable food is eaten, it is only its nutrient proximate principles which are extracted and absorbed by the digestive organs, the remainder being excreted as waste. When vegetable substances are used as medicines, a similar process takes place. The medicinal constituent or constituents are extracted by the system and produce their medicinal effects, either on the entire body or on the particular tissue or organ for which they have their selective affinity, the rest of the plant being non-assimilant. It is often preferable, instead of giving the entire vegetable substance, either as a food or medicine, to extract the useful proximate principles and use them in their purified form. This very

large collection, generously donated by E. Merck & Company, of New York, and valued at several thousand dollars, contains all of the more important proximate principles of plants, some of them being worth as much as five or ten dollars per grain.

Starches. Case 76.—Starch is largely formed by most plants, as a reserve food supply, from the water taken in through the roots and the carbonic acid gas inhaled from the atmosphere; the chemical combination is effected by the sun's energy, directed by the green coloring matter (chlorophyl). Starch is mostly found in the form of granules, sometimes in small rods, and is easily converted by the plant, or artificially, into glucose, in which form the plant consumes it. In darkness the plant consumes starch previously formed in daylight. Starch is insoluble in water and can therefore be easily washed out from ground plant tissue. The forms of the starch grains are so constant and characteristic in each plant that they afford an excellent method of identifying the latter, even in powder. Starch, as in the case of many other substances, exists in and is consequently derived from the several organs of various plants, for example, the roots of the cassava plant furnish the cassava flour and tapioca, while those of coontie yield coontie flour or Florida arrowroot, which is quite similar to sago, and those of the sweet-potato plant furnish sweet-potato flour. The rootstocks of the common potato plant abound in potato flour, while those of the arrowroot plant yield arrowroot flour. The stems of some of the sago palms and those of some of the true palms are the sources of sago flour. The fruits, both dry and fleshy, of a great variety of plants, contain starch; for example, those of the several grains, wheat, rye, and corn; while those of the banana yield the less common banana flour. The seeds of some plants are used as a source of starch.

Sugars. Cases 77 and 78.—Sugars are formed by plants at a stage in the manufacture of carbohydrate foods, and again when the carbohydrate is used by the plant as food,

as explained on our label, in the starch case. Although many varieties of sugar are recognized, they all fall into two great classes, cane-sugar and glucose. Cane-sugar occurs mostly in stems and roots, glucose in fruits. Glucose is cheaper than cane-sugar and if pure, is more healthful for human use, but the commercial article is very apt to be impure. Glucose is mostly manufactured from corn. Cane-sugar is mostly manufactured from sugar-cane, sugar-beets and sorghum cane. Sugar is a very important plant-product and it is of vast economic value. Sugar-cane (*Saccharum*) is the basis of the world's sugar supply. The juice from the stems of the plant is boiled down and by other processes is made into the principal crude products shown in the cases and later into the commercial grades of sugar, also shown.

The juices of other plants are also used in making sugar, for example, in temperate regions, the sugar-beet yields an enormous amount, the sap of the maple tree is made into maple-sugar, while in tropical regions the sap of various palms, such as the coconut-palm and the sugar-palm, is made into palm-sugar.

Fodder Plants. Cases 79–81.—These are mostly shown as sheaves. Fodders are derived chiefly from plants of the grass and bean families. Illustrations of the former are the varieties of hay known as timothy, red-top, blue-grass, and orchard-grass. Such hays are made by cutting the plants when in bloom or early fruit, and drying entire. Another form of the same class consists of the plants of the grains, wheat, rye, oats, and corn, cut while young and dried. When dried after the removal of their grain, they constitute straw. The corn-plant, cut young, is often chopped up and stored fresh in pits and bins. Such fodder is called ensilage. The grains themselves, separated from the straw, are largely used for fodder. Illustrations of the second class are the plants of clover, vetch, lupine, meibomia, and peas, cut in a similar stage of growth and dried into hay. Fodders of this class are much more nutritious than the grass-

hays, but are not so wholesome and must be fed sparingly, especially to horses.

Human Foods. Cases 85–114.—The utter dependence of man for sustenance upon vegetable products lends exceptional interest to the consideration of plants as foods. While it is true that man subsists largely upon animal food, these animals are themselves dependent upon vegetation, so that human dependence thereon is but one step removed. It is our intention, so far as possible, to have represented in our food collection every natural vegetable substance known to be used as food by human beings, and also many of the more important manufactured food products made from such substances. In the case of cultivated products, it is not practicable to represent all of the cultivated varieties, but in all cases, a sufficient number of them are exhibited to illustrate the nature and range of variation. The number of articles in this group is so great that it has been found necessary to adopt some special method of classification and arrangement. They have therefore been grouped in the following divisions:

A. Underground Portions.
B. Aerial Stems, Buds, Leaves or Leaf-stems and Flowers.
C. Fleshy Fruits and Seeds.
D. Nuts and Seeds eaten in the dry state, such as Marrow Beans and Peanuts.
E. The Cereal Grains and a few products of similar nature.

The articles in each of these classes are arranged in their natural botanical sequence, from the lowest to the highest plant.

Group *A*—cases 85 and 86—includes roots, rootstocks, tubers and tubercles, and bulbs. Although some fruits, such as the peanut, are produced subterraneously, it has been thought better to place them under fruits rather than in this group. In these cases will be found, not only such staple root-crops as potatoes, sweet potatoes, yams, taro, turnips, radishes, beets, and carrots, but also a large number of aboriginal foods, from many countries. Many of

these, while quite unknown to the general public, could probably be developed, through selection and breeding, into products of equal value with some of those now generally cultivated.

Group *B*—cases 87 and 88—includes such plant-stems as asparagus, pokeroot, and milkweed, such leaf-stems as pie-plant, celery and cardon, such buds as cabbage and brussels sprouts, leaves like spinach, Swiss chard, beet tops, and lamb's-quarters, and varieties of cauliflower.

Group *C*—cases 89 to 105—shows collections of fleshy fruits, including not only those commonly understood by this term, such as apples, grapes, and the berries, but those which, like string beans, are eaten as vegetables, but in their fresh state. It also includes seeds eaten in the fresh green state, like green peas and lima beans. It therefore comprises not only those sweet products which are commonly called fruits by the public, but also those which, like tomatoes, pepper, and okra, are eaten as table vegetables. This collection, in its entirety, is very large. Here will be found not only all the cultivated fruits of temperate regions, in many varieties, as well as those of tropical production, but also such wild edible fruits and berries as our collectors have accumulated from our own and many foreign countries. Aside from its economic interest, this group affords first-class material for the special studies of the morphologist and taxonomist.

Group *D*—cases 106 to 110—like its predecessor, contains a large number of articles in use in other countries, which are quite unknown to most persons in the United States. Prominent among such articles are some of the nuts and many varieties of beans grown in tropical countries, especially in Chile and the Philippine Islands. Of great interest also is quinoa, the seed of a species of lamb's-quarters of the Andes, constituting the principal food of the poorer classes in Chile, Bolivia, Peru, and Ecuador.

Group *E*—cases 111–114—comprising the cereal grains, is also very large, representing those of all countries, and

in a large number of varieties. Several hundred varieties of rice, chiefly from the Philippines, will be found of special interest. Of Indian corn, we show not only the highest product of modern plant breeding, but many primitive forms, not far removed from the original wild product. Dhoura or Kaffir corn is another highly important grain, little known among us except as a chicken food, but constituting the staple article of diet of millions of oriental people. Of the more common grains, such as wheat, oats, and barley, the products of different countries have been gathered, as well as sets representing the commercial grading by the New York Produce Exchange.

Drugs. Cases 115–174. Our materia medica collection is the largest in the Museum, with the possible exception of that of foods. It includes only the crude, ground, and powdered vegetable drugs, with a few constituents extracted from them. It has not been deemed advisable to include manufactured medicinal preparations, partly because of their great number, and partly because of their liability to deterioration when kept for long periods. It is not to be understood that the presence of a drug in this Museum is an endorsement, or even an indication of its value. It is recognized that a large minority, if not an actual majority of vegetable drugs that are or have been used, are either worthless or of so little value as not to be entitled to use. It sometimes happens, however, that new discoveries are made regarding the value of a drug previously regarded as worthless that reveals it as the possessor of important properties. It appears desirable also that such a collection should possess historical value, which is subserved by including in it all plants that have been considerably employed in medicine, without regard to the justification for such use.

The classification of these collections is of similar character to that of the foods. They are first grouped as underground portions, barks, woods, leaves, flowers, herbs, and twigs, fruits, seeds, and miscellaneous parts and products.

The articles of each of these groups are again arranged in the order of their natural botanical sequence, from the lowest to the highest plant.

Poisonous Plants of the Vicinity of New York. Cases 122 and 123.—While a vast majority of plants are innocuous, a number are decidedly poisonous, either to the touch or when taken into the system. Although many of them are not likely to be eaten, there are a few which, for special reasons, are very liable to be so, and which are the cause of many fatal accidents. Prominent among these are pokeroot, sometimes mistaken for horseradish, aconite root, often mistaken for the same condiment, pokeroot shoots, eaten like asparagus without proper precautionary preparation, veratrum leaves and stramonium leaves, eaten as greens, Cicuta roots, eaten for Jerusalem artichokes, and its stems, eaten for angelica, and belladonna fruits and stramonium seeds, sometimes eaten by children. Besides these, there are others which are liable to be eaten with evil results by live stock. Owing to imperfect knowledge of these poisonous species, accidents are liable to occur, on the one hand, while on the other, unjustified fear may prevent the use or handling of quite innocent plants. It has therefore been deemed desirable to have a very complete and carefully prepared exhibit of all poisonous plants, both wild and cultivated, growing in the vicinity of New York, which may be consulted or studied, especially by children. At the time of the printing of this Guide, this collection is very incomplete, so that it cannot be relied upon as a complete guide on the subject. Plans are perfected, and will be promptly executed, for the perfection of this exhibit.

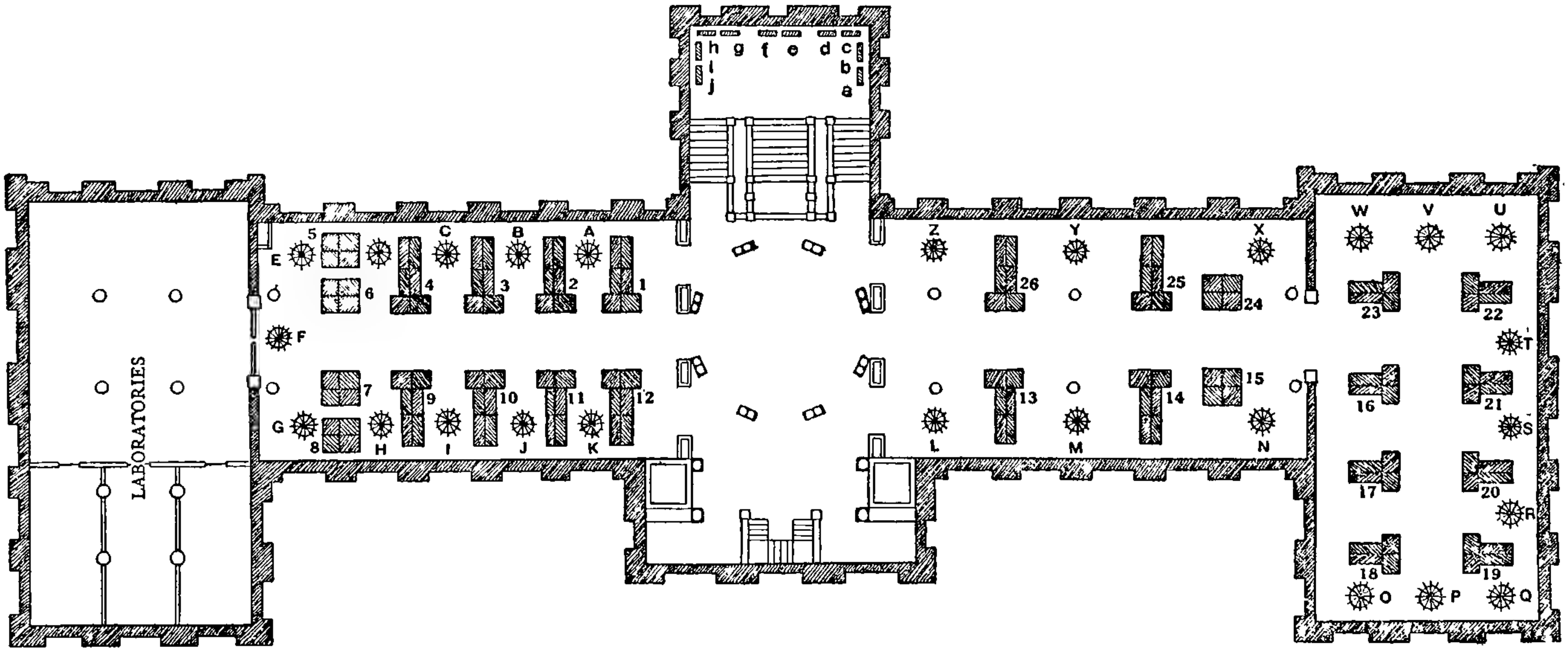
Insecticides. Case 124.—Many of the poisonous plants, and some which are not so, have a wide use for the destruction of insect pests, in the house, infesting cultivated plants, or even found upon the animal body. A number of these are here exhibited and to them additions are being made as opportunity affords.

Woods and Wood Products. Cases 181 to 195.—The great number of useful woods and their more important products precludes anything like a complete representation of those of the entire world, with our present means and equipment, although it is not improbable that such an exhibit may be undertaken in the future. In the meantime, the collection will be found to contain much of interest and value, and will be extended as our facilities permit.

Charcoal. Case 196.—Charcoal is the residue remaining after driving off the volatile constituents of wood, both those which exist naturally in it and those which are formed during the application of heat, oxygen being excluded to avoid the burning of the carbon. Although charcoal is chiefly employed as a fuel, it has many other important uses, different sorts being specially applicable for certain of them. One such use is in the manufacture of gunpowder, for which purpose the carbon must be free from silica, or other crystals capable of causing sparks by friction. Another use requiring very special properties is that for the carbons of incandescent electric lamps. Certain kinds of charcoal are specially useful in medicinal preparations. Our collection of these products is at present very small, but is nevertheless of considerable interest.

Miscellaneous Specimens. Case 197.—In this case will be found a number of interesting articles not properly referable to any of the special classes above enumerated, ornaments and toys being specially prominent. Many seeds and other plant parts are employed in the making of beads and decorative articles. The ivory nut, the very hard seeds of a species of palm, is largely used in the making of buttons, chessmen and various carved articles, substituting ivory for such purposes. This collection is capable of indefinite extension as a result of visits to countries inhabited by savages and other primitive peoples.

North American Dendrology. Cases 199–264.—The collection of North American Dendrology is based on specimens of the wood of all North American trees. To the



FLOOR PLAN, MUSEUM OF SYSTEMATIC BOTANY

1–26. Synoptic Collection
- 1–8. Case 1. Slime-moulds
- Cases 2–15. Sea weeds
- Cases 16–40. Fungi
- 9–11. Cases 41–43. Hepatics
- Cases 44–50. Mosses
- 12 and 13. Cases 51–55. Ferns and Fern-allies
- 12–28. Cases 56–58. Cone-bearing Plants
- Cases 59–128. Fruit-bearing Plants

A-Z. Local Flora

a–j. Microscope Exhibit

wood specimens are added specimens of twigs, of flowers, of fruits, and of other objects of interest from the various trees.

2. THE MUSEUM OF SYSTEMATIC BOTANY

This occupies the second floor of the building, except the west wing, and is designed to illustrate by specimens, drawings, and photographs, types of all the natural families of plants, beginning with those of the simplest structure and ending with the most complex. It consists of four series of objects:

(*a*) The general synoptic collection
(*b*) A series of microscopes showing selected specimens
(*c*) Illustrations of the local flora
(*d*) Plant photograph exhibit

(*a*) *Synoptic Collection.* This is designed to illustrate the plant world. A series of characteristic objects is installed as a basis for illustrating each plant-family. These specimens are accompanied as far as possible by plates, drawings or photographs, while on the shelves are arranged additional objects, such as flowers, fruits, woods, specimens of fossil plants, and models of various organs of plants, all intended further to illustrate the structural characteristics of the different groups. This collection is arranged according to the most natural and thus far most generally satisfactory interpretation of the interrelation of the plant-families; it may be considered as falling into two main series, namely, the flowerless or spore-bearing plants and the flowering or seed-bearing plants.

The flowerless plants fall into three phyla or subkingdoms: (1) the Thallophyta, in which the plant-body is not differentiated into stems and leaves, as represented by the slime-moulds, the bacteria and other micro-organisms, the seaweeds, the fungi, and the lichens (2) the Bryophyta, represented by the mosses and their immediate relatives; and (3) the Pteridophyta, including the ferns and the fern-allies.

The Thallophyta (cases 1 to 40), may be defined as plants without true roots, stems, or leaves; but notwithstanding their simple structure they exhibit an infinite variety of form and color.

The Myxomycetes or slime-moulds (case 1), standing at the bottom of the plant-scale, occupy the first exhibition case placed at the right hand side of the stairway from the main floor. They are thallophytes, having neither chlorophyl nor (in their vegetative condition) a cell-wall. These very simply constituted plants usually grow upon and derive their nourishment from decaying organic substances. They vary greatly in size, some being exceedingly minute, others assuming the form of relatively large irregularly shaped masses spreading in all directions as they grow. Most of the plants are small, and the structure is very delicate, in fact some are so fragile that a mere breath of air will ruin them.

Following the slime-moulds stand the cases devoted to the algae or seaweeds (cases 2 to 16), which may be briefly defined as thallophytes with chlorophyl, the green coloring matter of plants. The plants of this series are much more variable in form than those of the preceding, and are also much more numerous. Some forms are microscopic, others attain considerable size. The first case of the series is occupied by representatives of the blue-green algae (case 2) and the diatoms. The plants of these two groups are minute, so much so that in most cases the individuals can be well seen only with the aid of a microscope. As one finds them in nature they commonly form slimy or oozy masses which are not particularly attractive to the naked eye, but under a compound microscope they are of very great interest. Following the series just mentioned are the green seaweeds (cases 3 and 4), the group which includes the plants that are sometimes called the pond-scums, green slimes, green felts, and stoneworts. Some of these are microscopic; however, some of the green seaweeds attain a considerable size and begin to look a little more like what

are popularly termed "plants." After the green seaweeds come the brown ones (cases 5 to 8), and here the largest kinds are included. In their tissues is found a brownish pigment which obscures their green coloring matter. To this group belong the widely distributed "gulf-weed" or "sargasso-weed" (*Sargassum*) and the gigantic "great kelp" of the Pacific Ocean, which sometimes attains a length of more than a hundred feet. The seaweeds culminate in the red algae, a group in which the plants show some shade of red, pink, or purple; these (cases 8 to 15) exhibit a marvelous range of form and color. The last group of cases containing this series is given to the group of red algae which are known as the corallines, on account of their outward resemblance to the corals. These plants are thoroughly permeated with lime and are often as hard and stone-like as any coral, and build up reefs in the tropical oceans much as the corals do.

The next great type of plant life is the fungi (cases 16 to 40). These, like the plants of the preceding group, vary greatly in size and complexity of structure; but, unlike them, they are devoid of chlorophyl, the characteristic green matter which enables other plants to build up complex food for their nourishment, and consequently they are wholly different in their mode of life. Some are parasitic, deriving their nourishment from living plants and causing enormous damage to crops; others are saprophytic, deriving it from the remains of dead organisms; while others are symbiotic, living in such relationship with chlorophyl-bearing (green) plants that they mutually nourish one another, as in the case of mycorhizas. There are five generally recognized series here: First in order are the alga-like fungi (case 16, in part); these vary in form from simple masses of protoplasm to simple or branching threads. Here belong many of the moulds and similar forms which grow both on other plants and on animals. In case 16, also, have been installed specimens and illustrations of crown-gall, an abnormal growth which is caused by minute

plants known as bacteria. This peculiar growth is commonly known as vegetable cancer on account of its close resemblance to the cancer of the human body. The disease is very destructive to trees and shrubs of various kinds. Second we have the stalked-spored fungi (cases 16 to 29). This series falls into two groups, the one typified by the "rusts" and "smuts" which are commonly parasitic on the leaves and fruits of other plants; the other the great saprophytic group, well known through the mushrooms, bracket-fungi, stink-horns, and puff-balls. Third in this series are the spore-sac fungi (cases 30 to 35). In these plants the spores are borne in delicate membranous sacs, called asci, which in the more complex forms are collected into bodies of various shapes. The plants vary greatly in size and structure and may be either parasitic or saprophytic. To this group belong the yeasts and mildews; and also the chestnut-blight fungus. This disease, which has been imported into this country, has caused the death of all of the American chestnut trees in the immediate vicinity of New York City and threatens the entire destruction of this valuable tree. Some plants grow above the surface of the ground, as in the case of the morel; while others are subterranean, as in the case of truffles. Fourth in the series is the group known as the imperfect fungi (case 36). In this group the spores are borne directly on the threads or "hyphae" which constitute the vegetative portion of the organism. They are often parasitic on the leaves and on the bark of both wild and cultivated plants. The fifth and in many respects the most interesting of all the groups is that consisting of the lichens (cases 37 to 40). The lichens have commonly been considered to form an independent symbiotic group, each lichen being supposed to consist of a fungus and an alga living together, the one nourishing the other, but, according to some of the more recent students of the group, the lichens are simply fungi that live parasitically upon algae. The lichens are quite familiar to most people as plants of more or less leathery texture growing on rocks, on poor soil, or on the trunks of trees.

A step forward brings us to the Bryophyta. These are seedless green plants, most of which possess roots, stems, and leaves, but have no vascular tissue (cases 41–50). This group is best known through the mosses, which form its largest division. Of somewhat simpler structure are the hepatics or scale-mosses (cases 41 to 43). The stems and leaves of the hepatic plant are sometimes combined into a flat thallus-like body which creeps closely on the ground or other objects and resembles in aspect some of the lichens. The leaves, when present, are usually more delicate in texture than in the true mosses and they do not have a midvein. These differences alone enable one to distinguish a hepatic from its relatives by the unaided eye or at most by the use of a lens. In addition to these characters, the capsule or the receptacle which bears the spores, or reproductive bodies, usually splits into four valves when full-grown and the spores themselves are accompanied by spiral threads called elaters. The favorite habitat of hepatics is wet places, and mountains continually steeped in clouds yield a surprising variety of forms. Closely related to the hepatics, and commonly included with them, is the group Anthocerotes; these plants may, however, be distinguished by the presence of a central axis or column (columella) in the capsule, and there are several other important structural differences in their tissues.

The mosses (cases 44 to 50) follow the hepatics in order of development and complexity; they differ from them, however, in many respects. The stem and leaves have more differentiated tissues, and the leaves usually have a midvein. The moss capsule generally opens by a lid under which there are commonly appendages to aid in scattering the spores, which in this case are not accompanied by spiral threads as they are in the hepatics. The mosses fall into three primary groups: First the "peat-mosses" (*Sphagnum*), which differ from the rest of the mosses in the development of the tissue-structure of the capsule and in the spores; they grow in swamps and other wet places,

and their accumulation forms peat. The "black mosses" (*Andreaea*) differ from both of the other groups in the valvular capsule; they grow on dry rocks. The true mosses vary exceedingly in size and aspect. An examination of the specimens in the exhibition cases will convey to the mind a better idea of this group than may be gained from a description. They grow under all kinds of conditions from dry rocks to deep water. Many of the kinds grow on almost any kind of rock, earth, or bark of trees, while certain ones are more particular as to their habitat. Some will thrive only on limestone, which they often gradually disintegrate and partially preserve in the masses of closely set plants as a calcareous tufa; other species prefer ground that has recently been burnt over, as species of *Funaria* and *Leptobryum*, while others grow only on the bones of dead animals or in places where animal refuse has accumulated.

Next higher in the plant kingdom is the subkingdom Pteridophyta, or ferns and fern-allies, the seedless plants with roots, stems, leaves, and woody tissue (cases 51 to 55). The ferns as a group perhaps attract the attention of a greater number of people than any other series of plants. Associated with what are usually known as ferns are the fern-allies, for example the "horse-tails" (*Equisetum*), "lycopods" (*Lycopodium*), and "quillworts" (*Isoetes*), but these are usually less conspicuous than the "ferns." Fern-plants differ from all the plants of simpler organization in having vascular (woody) tissue, that is, a system of vessels for conducting sap through the different parts of the plant-body. They exhibit an almost infinite variety of form; their stems may be underground, horizontal on the ground, or erect; the leaves are either simple or compound, and sometimes perform both the work of foliage leaves and that of bearing the spore-cases (ferns), while in other cases some of the leaves have become changed into mere spore-bearing organs (cinnamon-fern).

The "flowering" plants (cases 56 to 128) comprise a single subkingdom, the Spermatophyta, or seed-bearing

plants. This extensive group seems to have followed two independent lines of development and consequently the plants fall into two well-marked groups, the first being the gymnosperms, cone-bearing plants, or plants in which the seeds are borne exposed in variously shaped cones (cases 56 to 58). This is a comparatively small group, but exhibits great diversity, including plants ranging from straggling shrubs or vines to the largest trees. The leaves, too, vary from structures resembling needles or scales to expanded fern-like structures of considerable variety. In a former geological age these plants were the dominant seed-bearing plants, but now the second group of the spermatophytes largely predominates; namely, the angiosperms, covered-seeded plants in which the seed is borne in a seed-case. These plants also existed in the later geological ages, and now form the most important and conspicuous part of the vegetation of the earth. The covered-seeded plants (cases 59 to 128) fall into two divisions, the one in which the embryo has a single leaf, the monocotyledons (cases 59 to 71); the other in which the embryo has two leaves, the dicotyledons (cases 72 to 128).

(*b*) *Microscope Exhibit.* The exhibition microscopes occupy small stands on the mezzanine landing between the first floor and the second floor. In front of the windows on the right, if one enters by the right stairway, are shown a few of the simplest and smallest forms of plant life. Under the lenses of the first microscope are representatives of the diatoms—one-celled organisms, some of which have the power of animal-like locomotion; the living substance of each cell is enclosed and protected by a hard transparent glassy wall consisting of two halves, one of which fits into the other like a band-box into its cover. The second microscope shows attractive and varied forms of fossil diatoms from California. Following this are shown "sea mosses," or "seaweeds," as they are commonly known, and closely related minute plants which inhabit fresh water and belong to groups often referred to

in popular speech as "pond-scums" or "ooze." In the natural unmagnified condition, many plants of this sort seem quite the reverse of attractive, but when placed under a sufficiently powerful microscope many of them reveal a rare beauty. The "sea mosses," or "seaweeds," gradually lose much of their natural beauty of coloration on prolonged exposure to the light, but the prevailing elegance and symmetry of form and structure persist.

Following the plants of the seaweed type are several representatives of the smaller fungi. The first of these specimens illustrates the resting spores of the parasitic fungus that causes the well-known rust of rose leaves. The second shows a vertical section through the cluster-cup stage of a fungus that draws its nourishment from the living tissues of the leaves of violets. Of the fungi which live upon decaying refuse matter, *Ascobolus* is one of the more interesting among those selected for exhibition. In this, the spores, or propagating cells, are borne in groups of eight within transparent ellipsoidal sacs, and at maturity these sacs, each enclosing eight spores, are ejected with considerable force. Under the next microscope are shown sections through the gills of a common mushroom, illustrating the manner in which its very minute and numerous spores are borne.

Then follow specimens of the liverworts or scale-mosses, plants in which the differentiation of the vegetative body into stem and leaves becomes first clearly evident. One of these, a *Frullania*, has a part of each leaf peculiarly modified so as to form a reservoir for water. By aid of this device, the frullanias and their allies are able to thrive in drier situations than are in favor with most of the order to which they belong. Preparations are exhibited showing also the vegetative structure and methods of reproduction of the true mosses. Especially interesting is the "peristome" of one of the mosses, which is a fringe of peculiar appendages surrounding the mouth of the little urn in which the minute dust-like spores are borne. These ap-

pendages move about as a result of changing conditions of moisture and these mechanical movements assist in scattering the spores. A somewhat analogous device is found in connection with the spores of the equisetums or horse-tails, though the appendages in this case are attached to the spores. Near the slide illustrating this feature of the horse-tails is one showing the spores and spore-cases of the common polypody; the spore-case here is provided with a sort of spring, by the action of which the spores are violently ejected, catapult-fashion. Another preparation shows the structure of the stem of the moonwort (*Botrychium*) as it appears in a cross section. And yet another shows a cross section of the submerged stem of an aquatic plant with its large air spaces and poorly developed strengthening tissues. On the last table, at the left as one enters the landing, is a preparation showing "pollen-grains" from the flowers of a shrub of the mallow family, the grains being in this case globular and covered with small sharp points. Grains of this sort are carried by bees from the anthers of one flower to the stigma of another, thus resulting in cross-fertilization. The last slide illustrates the structure of the wood of a young pine stem in cross section and brings out clearly the anatomical basis of the annual growth rings.

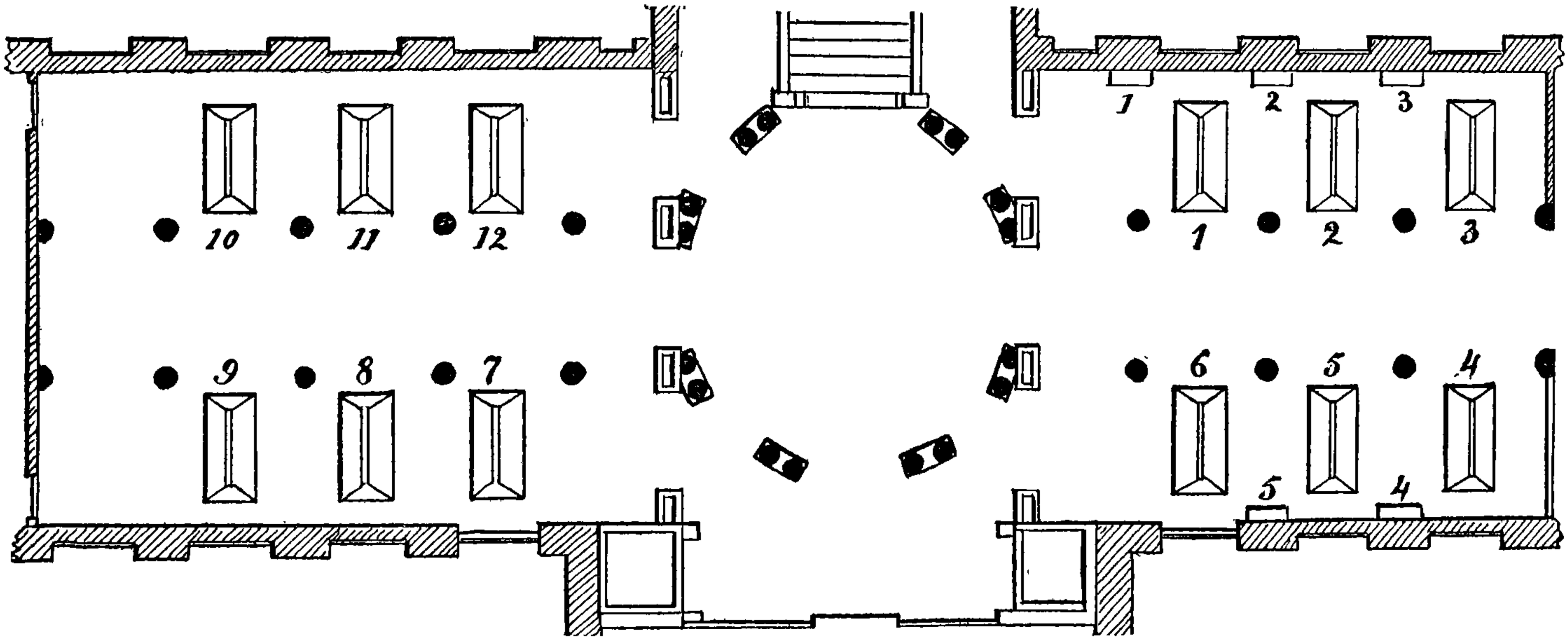
(*c*) *Local Flora.* In this collection it is designed to illustrate every plant-species growing naturally or without cultivation within one hundred miles of New York City. For the most part specimens of the plants themselves are used, but in cases where the structure of the plants renders this method undesirable, or impossible, a photograph or a drawing is substituted for the plant-specimen. This collection is displayed in swinging frames which are placed so as to correspond in a general way to the sequence of the cases of the synoptic collection already described; thus, the first stand is near the first museum case as one enters the west hall from the top of the staircase. All of the plant groups are here represented by those members that

occur locally, and the characteristics of the several groups as mentioned under the synoptic collection also apply here.

(*d*) *The Plant Photograph Exhibit.* A series of over 200 enlarged photographs, illustrating plant societies, habit-characters, flower-characters, and fruit-characters of the higher plants, as well as habit and structural characters of some of the larger algae and fungi, is displayed in frames fastened to the walls of the systematic museum. As far as practicable, they have been placed near the cases containing representatives of the species illustrated. The photographs are 11 x 14 inches in size and are mounted in glazed frames, some frames containing 4 and others 6 photographs.

3. THE MUSEUM OF FOSSIL BOTANY

This collection, installed in the basement, is designed to show the successive stages of evolution through which the ancestors of our living flora have passed since the time of the first appearance of plant life on the earth, as far as the remains of extinct plants have been preserved. The general arrangement adopted is therefore based upon the sequence of the geological time divisions: Eozoic, Paleozoic, Mesozoic, and Neozoic, and their subdivisions into periods; Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, Quaternary, and Modern. This arrangement is therefore geological, but incidentally it is also biological, and follows the same system as that on which the synoptic collection of the museum of systematic botany is arranged, inasmuch as the plants of the earlier periods are low in the scale of life, consisting of thallophytes and pteridophytes and plants of uncertain botanical determination, while those which appear in the successively later periods are of successively higher and more complex types, represented by cycads, conifers and both monocotyledonous and dicotyledonous plants closely related to our living flora.



FLOOR PLAN, MUSEUM OF FOSSIL BOTANY

Floor and wall cases 1. Plants of Eozoic Time, Laurentian Period, and Paleozoic Time, Cambrian, Silurian, Devonian and Carboniferous Periods

Floor and wall cases 2–4. Plants of Paleozoic Time, Carboniferous Period

Floor case 5. Plants of Mesozoic Time, Triassic and Jurassic Periods

Wall case 5. Specimens showing methods of fossilization

Floor case 6. Plants of Mesozoic Time, Cretaceous Period (Raritan)

Floor case 7. Plants of Mesozoic Time, Cretaceous Period (Raritan and Cliffwood)

Floor case 8. Plants of Mesozoic Time, Cretaceous Period (Dakota)

Floor case 9. Plants of Mesozoic Time, Cretaceous Period (Laramie)

Floor case 10. Plants of Neozoic Time, Tertiary Period (Eocene)

Floor case 11. Plants of Neozoic Time, Tertiary Period (Miocene)

Floor case 12. Plants of Neozoic Time, Tertiary (Miocene and Pliocene) and Quaternary Periods

Each specimen on display, with the exception of the very large ones, is placed upon a separate wooden block, and each one is labeled, giving the generic and specific name; the family, order, or class of plants to which it is referred; the geologic period and subdivision in which it belongs, and the locality or region where it was collected. All essential information of a botanical and geological nature in relation to each specimen is, therefore, included in the label. Whenever a figure of any specimen can be obtained this is placed on the same block with the specimen, and pictures of ideal landscapes, showing the extinct vegetation of certain geologic periods, as well as restoration of certain extinct plants, are displayed in their proper cases. The series of exhibits begins in the first cases to the left as one enters the east hall of the basement. The sequence of the specimens in the wall cases corresponds to that of the floor cases.

In floor- and wall-cases Nos. 1 to 4 may be seen representatives of Eozoic and Paleozoic Time: Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian and Carboniferous Periods. In floor- and wall-case No. 1 are specimens of graphite of Eozoic age and of anthracite and bituminous coal of Carboniferous age, showing the transformation of vegetable matter into the ultimate condition of pure carbon in the form of graphite or "black lead" in the oldest rocks. Other specimens in this case, classed as algae, are of uncertain botanical relationship, as the structure of the primitive plants was not well adapted for preservation as fossils. For example, some organisms appear as mere filamentous strips of graphite in white limestone, without any trace of the original structure remaining, while others may be seen as casts and impressions which closely simulate in general appearance different parts of the seaweeds now existing. In this series of problematic fossils are also included a number of forms at one time definitely classed as plants but now by some assumed to be of animal or inorganic origin; namely, *Scolithus*, which

may be caused by worm burrows; *Phytopsis*, which may be a coral; *Plumulina*, which may be a hydroid; *Dendrophycus*, which may be current-markings; and Dictyolites, which are most likely sun-cracks. All of these, however, have at one time or another been definitely regarded as the remains of marine plants and were originally so described and classified.

In these cases and in wall-case No. 2 are also the remains of the earliest fern-plants and their allies (Pteridophyta) of Devonian and Carboniferous age, represented by *Lepidodendron*, *Sigillaria*, and *Calamites*, and the early seed-bearing plants, the cone-bearers (Gymnosperms), represented by *Cordaites*, with the fossils under *Trigonocarpon*, *Rhabdocarpon*, and other genera.

Floor-cases Nos. 2 and 3 and wall-case No. 3 contain specimens of Carboniferous age, for the most part ferns or fern-like plants, which were originally described as ferns, but which are now placed in a different group, the Cycadofilicales, that is, plants that had characteristics of both the ferns and the sago-palms, but more closely related to the latter than to the ferns.

Floor- and wall-cases No. 4 are devoted to specimens of Carboniferous plants in the genera *Lepidodendron*, *Sigillaria*, and *Stigmaria*, in order to show the variation in the arrangement and shape of the leaf scars and the difference between specimens with the bark preserved and those which have been decorticated.

Floor-case No. 5 contains types of early Mesozoic time: Triassic and Jurassic Periods. The plant remains in this case are mostly sago-palms or cycads, with a few cone-bearers and fern-plants, besides specimens of the so-called "*Glossopteris* flora," a flora of uncertain botanical relationship, which flourished in the transition period between Paleozoic and Mesozoic time, particularly in the southern hemisphere, and may yet be represented by the living South African genus *Stangeria*, a cycad having leaves with pinnately arranged forking veins, similar to ferns.

Floor-case No. 6 encloses plant remains from the rocks of later Mesozoic time: Lower and Middle Cretaceous Period. These specimens represent the first appearance of the higher-seed-bearing plants (Angiosperms), the type which is dominant in the existing flora. The genera are in most instances apparently identical with those now in existence, but the species are extinct. The plants of the Lower Cretaceous consist largely of ferns and cone-bearers, while those of the middle Cretaceous show a preponderance of angiosperms.

Floor-case No. 7 is arranged to show specimens of the Middle Cretaceous flora found within the limits of the City of New York, on Staten Island, or in the immediate vicinity in New Jersey and on Long Island.

Floor-case No. 8 contains specimens from the Middle Cretaceous of the western States. Those from the Dakota Group are exceptionally fine, many of them being perfectly preserved and showing both case and impression of the same leaf as counterparts.

Floor-case No. 9 is devoted to plants of the Upper Cretaceous (Laramie Group), and completes the vegetation of Mesozoic time.

Floor-cases Nos. 10 to 12 and wall-case No. 5 contain plant remains of Neozoic time. Those of the early Tertiary Period (Eocene) are displayed in floor-case No. 10. Those of the later Tertiary (Miocene) and Quaternary Periods in floor-cases Nos. 11 and 12. The specimens in the latter case complete the sequence of plant life on the earth and bring it up to modern times. A number of specimens at one end of the case show the methods of preservation by petrifaction, incrustation, and carbonization, and on the upper shelf is a series of specimens from Quaternary and more recent swamp deposits which show how the conversion of living plants into fossils, a process now going on, has its beginning.

The specimens in wall-case No. 5 further illustrate the characteristics of the plants of the late geological periods

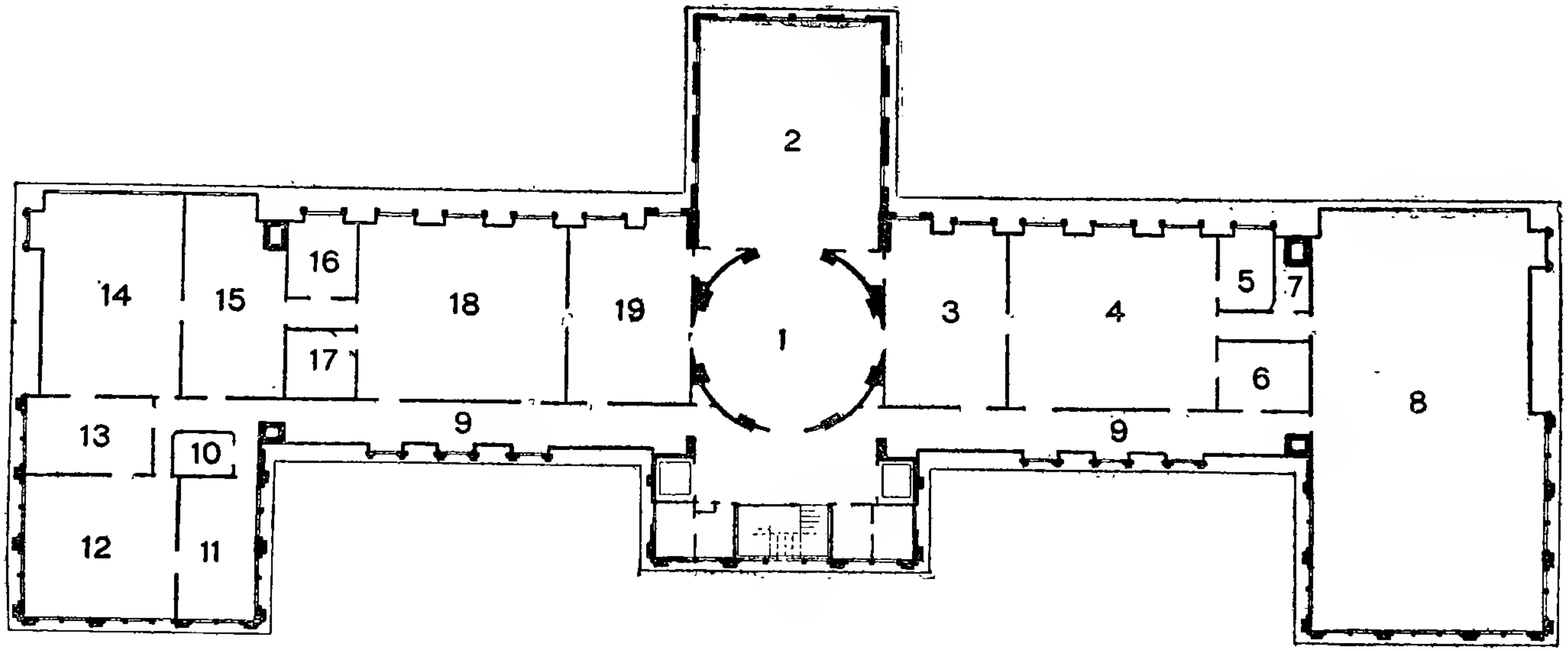
and the methods by which the various plant structures have been preserved. A number of specimens of silicified woods show the method of preservation by what is known as petrifaction, or conversion into stone, in which the woody structure is replaced by mineral matter. Other specimens show preservation by incrustation, in which mosses and the stems of reeds are coated or incrusted by mineral matter deposited from springs; while on the upper shelf on the top of the case are logs and stumps from old swamps and interglacial deposits, in which the wood has been partially carbonized, or converted into lignite, by the slow process of natural distillation. This process represents the beginning of the conversion of vegetable tissue into coal.

LECTURES

Other features of the museum building include the large public lecture hall, with a seating capacity of over seven hundred, which occupies the western end of the basement. It is equipped with an electric projection-lantern, and free public popular lectures covering a wide field of botanical and horticultural subjects are delivered here on Saturday afternoons from spring to autumn; these are fully illustrated by means of a very extensive collection of lantern slides owned by the Garden which is constantly being increased. A noteworthy part of this collection is the series of delicately and accurately colored slides of flowers, fruits, trees and shrubs, by Mrs. Adelaide S. Van Brunt, from photographs made during many years by her late husband, Cornelius Van Brunt.

The Horticultural Society of New York holds several of its monthly meetings at the Garden, using the large lecture hall, and also uses the basement museum hall adjacent for the purpose of exhibitions.

The Torrey Botanical Club holds monthly meetings from October to May, on the afternoon of the last Wednesday of each month, in the museum building, and several of its field



PLAN OF UPPER FLOOR OF MUSEUM BUILDING

1. Library Reading Room
2. Library Stack Room
3. Director's Room
4. Herbarium of Ferns and Lichens
5. Curator's Room
6. Moss Herbarium
7. Storeroom
8. Main Herbarium
9. Hall
10. Photographic Dark Room
11. Work Room
12. Chemical Laboratory
13. Study
14. Herbarium Extension
15. Study
16. Study
17. Physiological Dark Room
18. Botanical Laboratory
19. Library Extension

meetings on Saturday afternoons throughout the season are held at the Garden.

THE LIBRARY

The library of the Garden is located in the center of the upper floor of the museum building, and is available for consultation, by permission. It has been formed by the Board of Managers in order to provide for the use of students, all the literature of botany, horticulture and related sciences, and is rapidly becoming one of the most complete collections of books and pamphlets in the world dealing with these subjects. It consists of a reading-room, circular in shape, and two stack rooms opening off from it. The collection contains over 30,000 bound volumes.

In addition to its own books, the library has on deposit many of the botanical works belonging to Columbia University and the New York Academy of Sciences.

The Cox collection of Darwiniana, named in honor of the late Charles Finney Cox, by whom the collection was made, consists of a complete set of the works of Darwin. These books occupy a specially constructed cabinet which stands near the center of the reading room.

Manuscript letters of botanists, as well as many portraits of botanists, are also on file.

THE HERBARIUM

The herbarium consists of dried specimens of plants systematically arranged in cases; it occupies the greater portion of several rooms on the upper floor of the museum building, and is available for consultation by permission. It contains prepared specimens of all kinds of plants from all quarters of the globe, and is the most extensive and complete collection of its kind in America. It comprises the Garden herbarium and the Columbia University herbarium. The latter is one of the oldest collections of its kind in the United States, having been begun by Dr. John Torrey

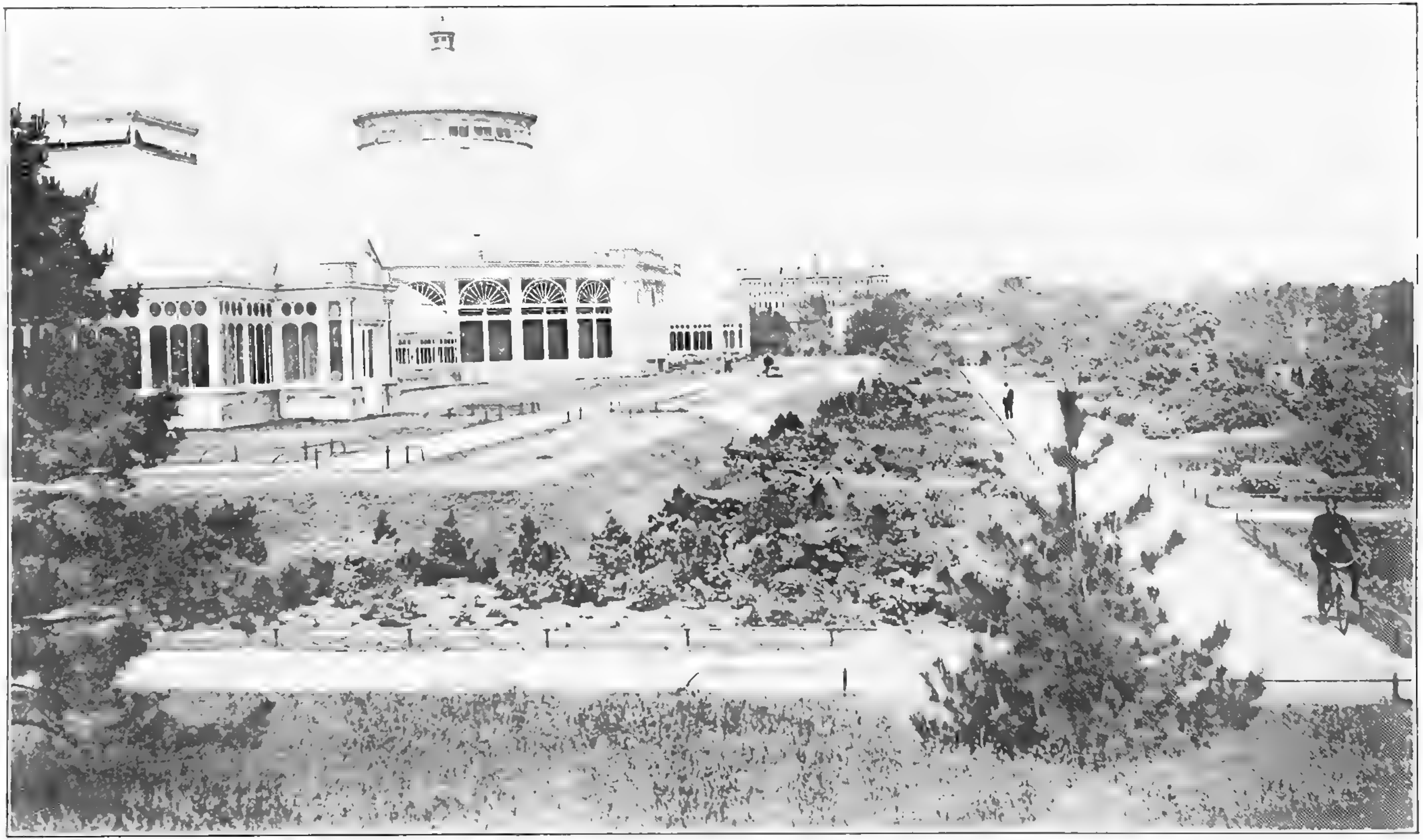
soon after the commencement of the last century. After half a century of natural growth several large herbaria were incorporated in it and large sets of special collections were added to it. The Garden herbarium was begun with the inception of the Garden. It has grown rapidly and now far excels the Columbia herbarium in the number of specimens. The rapid growth of the Garden herbarium and its importance is due to the fact that it is built up of approximately thirty different herbaria which represent plants of all groups from all parts of the globe. To this as a basis have been added miscellaneous collections and the first sets of the plants secured by members of the Garden staff while exploring in different parts of the New World and the Old.

The great majority of specimens are mounted on herbarium sheets, but many thousand specimens, such as bulky fungi, fruits, seeds, and other parts of plants not suitable for placing flat on herbarium sheets are contained in cardboard boxes of multiple sizes.

The herbarium now comprises more than one and one-half million specimens. All groups of the flowerless plants and flowering plants are copiously represented.

THE LABORATORIES

Laboratories and working rooms for research are provided on the upper floor of the museum building, and properly qualified students of botany are permitted to make use of this equipment, under the direction of some member of the staff of the Garden. The equipment is designed to meet the needs of a very broad field of investigation, including plant chemistry, pathology, physiology and morphology. An experimental garden and greenhouse at the nurseries are used in connection with the laboratories. A valuable series of old microscopes, illustrating the history and development of that instrument, was presented by the late Mr. Charles F. Cox.



PUBLIC CONSERVATORY RANGE 1, AND FLOWER GARDENS

2. Public Conservatory Range 1

This great glasshouse, located but a short distance from the 200th Street Station of the Third Avenue Elevated Railway, is 512 feet in length, with a central dome about 90 feet in height, and wings extending from the main range in such a way as to form a court open to the southwest. The area under glass is about one acre. The building stands on a terrace 5 feet in height, approached by six flights of cut granite steps connecting with the path and driveway approaches. The house contains fifteen compartments, separated by glass partitions and doors.

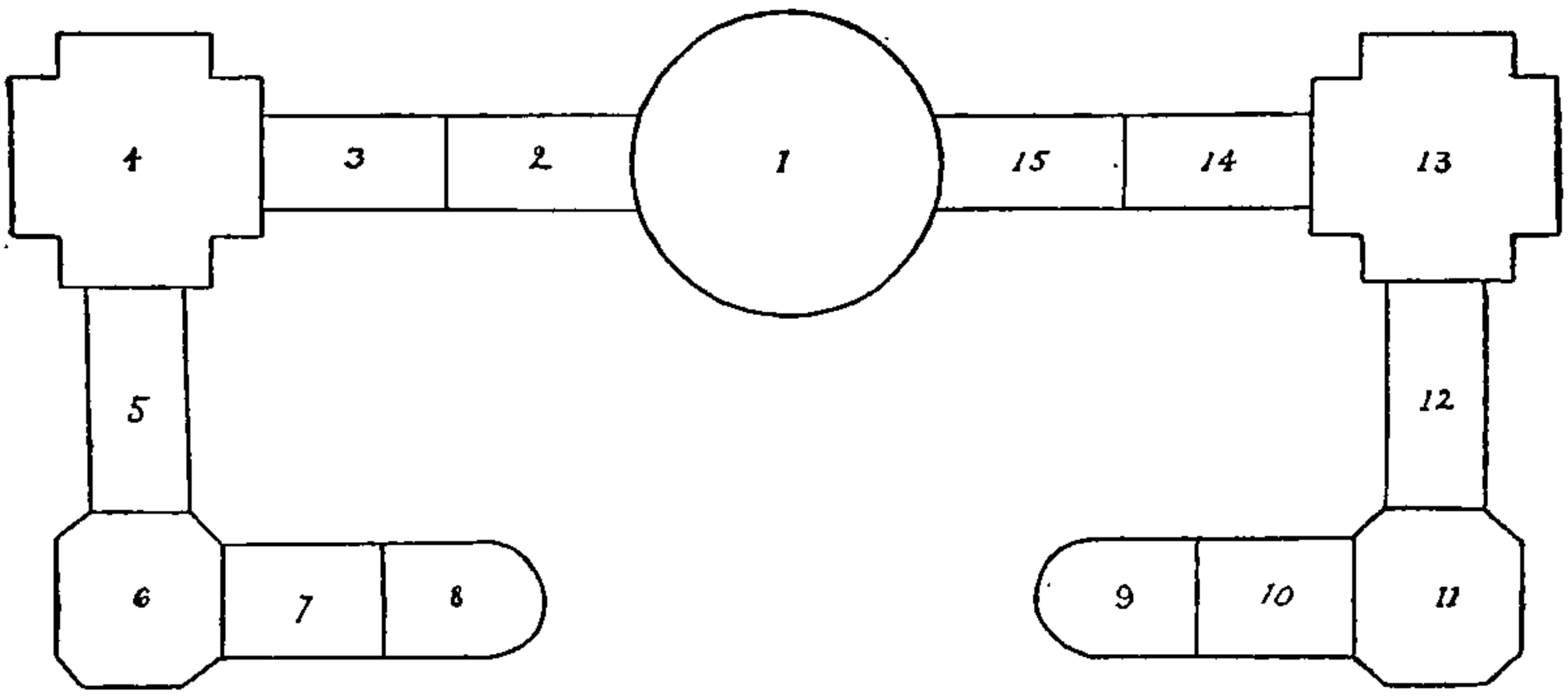


Fig. 1. Ground plan of Conservatory Range 1.

House No. 1 contains palms of numerous species from all parts of tropical and warm regions, both of the Old World and the New. Of West Indian palms, the collection contains the royal palm of the West Indies, Florida, and Panama; an elegant plant of the corozo palm (*Acrocomia aculeata*) of Jamaica, Porto Rico and the Windward Islands; and the cocoanut palm, planted in all tropical countries for its fruit and for the numerous uses to which its fiber, wood, and leaves are applied—it is not definitely known that the cocoanut palm is a native of the West Indies, and where in the tropical regions it actually originated is uncertain. Other tropical American palms are illustrated by the silvertop palm (*Coccothrinax argentea*), of Florida and the

West Indies and by the curious Mexican *Acanthorhiza aculeata* with spine-like roots on its trunk. Old World species are shown in a very large tree of the Chinese fan-palm, and by numerous other large species from the Pacific islands. Another Old World palm is *Calamus asperrimus*, of Java, curious in its climbing habit; the specimen here is over one hundred and seventy feet long; the long tail-like appendages to the leaves, which have backwardly turned spines, enable the palm to climb on surrounding vegetation. Related to the palms and shown by numerous specimens in this house, we find a number of species of the Panama hat-plant family, the most conspicuous being the Panama hat plant (*Carludovica palmata*), from the young leaves of which the costly Panama hats are made. Opposite the entrance to the court is a plant which belongs to the grass family, the Chinese bamboo (*Bambos vulgaris*), whose stems reach into the upper part of the dome; this plant grows with great rapidity each year by new shoots which come up from under ground, our measurements showing that they reached 65 feet in height in 95 days, a rate of about 8 inches a day. The plant has been introduced into the West Indies, and in places where it grows its stems are put to a great variety of uses in construction, for water pipes, and for various utensils.

Houses No. 2 and No. 3 contain a collection of exogenous tropical plants. These are arranged in botanical sequence, the families appearing to the right or left of the walk, or both, as cultural conditions require, the sequence beginning at the east end on the north side, proceeding to the west end of house 3 and returning on the south side of the two houses, and terminating at the east end of house 2. On the right, as one enters from the north door from house 1, is a collection of the pepper family, Piperaceae. These are largely of the genus *Peperomia;* many of these plants have been collected by Garden expeditions to the West Indies. Plants of the genus *Piper* are usually large, and the larger ones will be found in the center nearby.

The nettle family follows, represented by such plants as the odd *Procris; Pilea*, in several species, including *P. microphylla*, the artillery plant; the Gyrupia poison-tree, a native of Australia, one of the most vicious of the stinging nettles—at fruiting time the dull purple of its fruit makes it quite attractive; and the two-lobed *Boehmeria*, from Japan. The flat-stemmed *Muhlenbeckia*, native of the Solomon Islands, belongs to the knotweed family. As one proceeds, many species of figs will be found, including the common rubber plant of our homes. Further on is the laurel family, one of the interesting plants belonging here being the alligator pear, the fruit of which is edible and much used as a salad, and otherwise, in the tropics. Near this is the custard-apple family, including the cherimoyer, an edible fruit, native of tropical America. Nearby are the senna and mimosa families, represented by numerous individuals. To the senna family belongs the poinciana, commonly grown in Florida and tropical countries on account of its decorative red flowers. To the mimosa family belong the sensitive plants, of which there are two here which show this characteristic noticeably, *Mimosa pudica* and *Mimosa Spegazzinii.*

Near the west end of house 3 is a collection of the spurge family. Here will be found the genus *Codiaeum* in many colored forms, usually known as garden crotons. Other genera represented are *Croton*, *Phyllanthus*, *Xylophylla*, *Antidesmia*, and *Acalypha.* Here, also, are two plants of the curious West Indian ivy, belonging to the genus *Marcgravia.* On the south bench of this house is a large collection of begonias. Entering house 2, the north side of which we have already visited, we find more begonia plants on the south bench, and nearby the meadow-beauty family, largely represented in tropical regions, to which belongs our native meadow-beauty, *Rhexia virginica.* Other families following are the vervain, acanthus, potato, madder and thistle, the last two near the east door.

House No. 4. Here are brought together many kinds of large tropical plants belonging to families also represented in the smaller houses, but too tall to be grown on the benches.

In this house may be found large specimens of the aroid family, the most noteworthy one of these being a magnificent plant of Veitch's tail-flower (*Anthurium Veitchii*), from Colombia, which is believed to be the most elegant plant of its kind in cultivation; climbing on trunks of trees set as supports, will be found a number of vines of the genera *Philodendron* and *Monstera*, one of these, *Monstera deliciosa*, a Mexican plant, producing an edible fruit, with the odor of pineapple. Another is *Monstera lata-vaginata;* the early leaves differ widely from the mature ones. The main aroid collection will be found in house 10, and other plants at range 2, houses 16, 18, and 20.

A large tree of the common rubber plant, much grown in parlors, may be found in the center of this house, reaching to the roof; this is a native of tropical Asia and yields some rubber, but not in as great quantity nor of as good quality as the other rubber trees of South and Central America; it is a species of fig (*Ficus elastica*); other species of *Ficus* are shown in this house, notably a fine tree of Roxburgh's fig, which bears its inedible fruit in bunches near the base of the tree, and a specimen of the Banyan tree (*Ficus benghalensis*). Chocolate trees (*Theobroma Cacao*), native of tropical America, may be found here; the small white flowers are produced on the trunk and on branches, and a few of them develop into the large woody pods containing the seeds or chocolate beans, which are dried and ground up into chocolate and cocoa; specimens illustrating the chocolate industry will be found in the economic museum. The papaya, or papaw, also of tropical America, is here also; its fruit, esteemed as an aid to digestion, is borne just under the crown of leaves. A specimen of the bread-fruit tree (*Artocarpus incisa*) may also be seen here; originally from the islands of the Pacific, it was introduced into the West Indies in the latter part of the eighteenth century.

Several interesting tall vines climb on the pillars of this house, and on supports along the sides, among them the night-blooming jessamine (*Cestrum Parqui*) of tropical America, which opens its flowers after dark and exhales a delicious perfume, the flowers remaining open during part of the morning; Henderson's *Allamanda*, of Brazil, with its showy large yellow flowers, climbs to the roof.

House No. 5. The plants in this house are from desert regions. Especial attention is called to their fleshy stems or leaves which serve as storage organs for a water supply to carry them over periods of drought. On the right hand bench, as one enters from No. 4, are mainly plants from southern Africa: the carrion flowers (*Stapelia*), relatives of our common milkweed of the roadsides; *Gasteria*, *Haworthia*, and other South African representatives of the lily family; and the fig-marigolds, *Mesembryanthemum*, belonging to the carpet-weed family.

On the end of the center bench, opposite to the entrance from house 4, is the collection of the fleshy members of the spurge family, Euphorbiaceae, mostly natives of the Old World. These closely resemble forms of the genus *Cereus* and related genera of the cactus family, to be found in houses 6 and 7. In fact, the adaptation to an arid environment, by the thickening of stems or leaves, is strikingly illustrated in the plants of several families contained in the collections in houses 5 to 8. On the center bench are the aloes, mainly South African members of the lily family. A part of the center bench and the side bench on the east side are devoted to members of the orpine family, many of these interesting and beautiful forms. The echeverias from Mexico and Central America, and the sempervivums or house-leeks, from the Old World, are conspicuous among these. Among other genera represented are *Sedum*, *Kalanchoë*, *Pachyphytum*, and *Crassula* (in house 6 are large specimens of *Crassula portulacea*). Many of the stonecrops are hardy plants, and a collection of these may be found at the herbaceous grounds. A large number of

specimens belonging in this house and in the three following ones may be found during the summer in the beds in the conservatory court.

House No. 6. This is also a desert house. On the corner benches is a collection of century plants (*Agave*), a large genus known only from the New World; other and larger plants of this same genus may be found in the central portion of the house. Conspicuous among these are: the thread-bearing agave, Queen Victoria's agave, the sisal plant (*Agave sisalana*), and the common century plant (*Agave americana*). The first two are decorative and curious; from *Agave sisalana* is manufactured the sisal hemp of commerce; the last, *Agave americana*, is well known, and it is from the sap of related species that the Mexican drink "pulque" is obtained by fermentation. It is popularly believed that the century plants flower but once in a hundred years, and then die; it is true that the plant dies when done blooming, but it blooms at a much earlier age than a century, sometimes when but eight or ten years old. The collection of West Indian agaves is especially rich in species.

A group of the dracaena family may be found in the central portion of this house. This comprises members of the genera *Yucca* and *Dasylirion*. A group of cacti may also be seen here, the most imposing figure of which is the giant cereus, *Carnegiea gigantea*, known as "sahuaro" by the Mexicans and Indians of its native country, Arizona and Sonora. The plants here shown were obtained by an expedition sent to those regions by the Garden in 1902, and are the largest specimens in cultivation in the east. Several large specimens of the hedgehog cactus, secured at the same time, form part of this group; the Indians in the desert often secure a supply of drinking water from these plants by cutting off the top and macerating the interior substance.

Houses Nos. 7 and 8 are wholly occupied by the cactus family. The collections here have been greatly enriched

and enlarged in the past few years by extensive explorations made in South America, in cooperation with the Carnegie Institution, and from other sources. These collections, the richest in species in the world, have been assembled to facilitate the production of a monograph on this family now in course of preparation by the Garden in cooperation with the Carnegie Institution. In addition to the plants in these houses, many hundreds of others are located at the propagating houses. Nearly all these plants are devoid of leaves, these organs, when present, being mostly small and inconspicuous; in the genus *Opuntia* they are usually present on the young growths as awl-shaped bodies, while in some few species they are much larger and remain for some time; in the genus *Pereskia*, specimens of which will be found in house No. 8, the leaves are large and well developed. The stems of the cacti are fleshy and assume a great number of forms: in *Opuntia* the stem is composed of joints, either cylindric or broad and flattened; in *Cereus* and related genera the stems are angled; in *Carnegiea* they are thick, massive columns with many longitudinal ribs; in *Echinocactus* the plant-bodies are but little elongated, or almost globular; while in other genera the plant-body is covered with rows of spirally arranged projections. The flowers of many cacti are exquisite in form and color; they are borne on various parts of the plant-body, in the Turk's-head cactus on a curiously modified portion of the top.

In house 7 on the center bench is the genus *Cereus* and its many related genera, *Pachycereus*, *Cephalocereus*, *Leptocereus*, *Acanthocereus*, *Nyctocereus*, *Hylocereus*, *Selenicereus*, *Harrisia*, and others. Among these is the old-man cactus, *Cephalocereus senilis*. On the west and north side benches is a collection of the genus *Epiphyllum*, often known as *Phyllocactus*. The broad flattened parts of these plants are stems and not leaves, the flowers being borne in the notches along their edges. The flowers are very showy, many of them beautiful in the extreme. On the south

and west side of the center bench are plants of the hedgehog cactus, *Echinocactus*, and also of *Echinocereus* and *Echinopsis*. On the south bench is a collection of cactuses, largely of the genus formerly known as *Mamillaria*. Here also will be found specimens of *Echinocereus*, *Echinocactus*, and of the curious Turk's-head cactus which bears its flowers on the red cap to the plant, hence its popular name.

House 8 is mainly devoted to the collections of the genus *Opuntia*. On the center and north benches are the platyopuntias, those with broad flat joints, while on the south bench will be found the cylindropuntias, or those with rounded stems. Among the platyopuntias are a number of plants of Burbank's so-called spineless cactus; these were obtained direct from Mr. Burbank in 1912, and it is curious to note that many of them are now developing spines. It is claimed that these plants are valuable for fodder in arid regions. As already remarked above, the leaves of the opuntias are usually small and awl-shaped and occur on the young growths. In this house will also be found the genus *Pereskia*, in which the leaves are normally developed. One of the commonest of these is the Barbados gooseberry, *Pereskia Pereskia*, of tropical America. *Pereskiopsis* is a related genus of which a number of species will be found here; its leaves are also well developed.

An interesting economic plant in this house is *Nopalea coccinellifera*, upon which the cochineal insect breeds; it is from these insects that the dye cochineal was obtained. *Nopalea* much resembles the flat-stemmed *Opuntia* in its plant body, but is distinguished readily by its different flowers.

Few of the cacti are of economic importance. A number of different kinds are used for hedges in tropical America. Certain species of *Opuntia* produce edible fruits known as Indian figs. These are offered for sale in the fruit stores in New York at the proper season. In the island of Grand Turk certain species of *Opuntia* which grow there are used in making a soup, known as pear soup, the young joints of the plant being used for the purpose.

House No. 9. This is the aquatic house, and plants which find their homes in the water or require much moisture are brought together here. From the bridge spanning the pool the various features may be readily observed. Fringing the pool on the right, as one enters from house No. 10, are members of the sedge and grass families, while on the left hand side the fringe is made up entirely of grasses, largely of the graceful bamboos. Of special interest among the sedges is the Egyptian paper-plant (*Cyperus Papyrus*), from which many of the ancients obtained their writing paper. Among the grasses by far the most important is the sugar cane (*Saccharum officinarum*); from the lower portions of its stalks the juice is extracted by pressure, and from this juice molasses and sugar are manufactured. Among the plants in the pool are many with attractive flowers; conspicuous among these being water-lilies (*Castalia*), of which there are several different kinds; the water hyacinth; the parrot's-feather, with its delicate feathery masses of green; the water poppy; the water snowflake; the water lettuce and golden-club, members of the arum family; the floating fern; and some odd little plants related to the ferns, members of the genus *Salvinia*.

House No. 10 contains specimens of the aroids, represented by a large number of different species, located on and under the benches. The plants of this family (*Araceae*) are mostly of tropical distribution, but they are represented in our northern flora by the skunk cabbage, the jack-in-the-pulpit, and the sweet flag; the most familiar one in cultivation is the calla lily (*Zantedeschia aethiopica*), not botanically a lily. The plants all have spikes of very small flowers closely massed together, and usually subtended by a broad leaf-like structure which is known as the spathe; this is usually highly colored, pure white, yellow, red or scarlet, and is commonly thought of as the flower, though not botanically so; species of *Anthurium*, known as tail-flowers, are abundant in the West Indies and tropical America, as is the genus *Philodendron*, signifying tree-loving, on account of

many species being vines climbing high on the trees in tropical forests; numerous species have underground stems and branches which contain much starch and are cultivated in the tropics for food, under the name of yautias and taros. Plants of the same family, too large for exhibition in this house, may be found in house No. 4. Others will be found at range 2, houses 16, 18, and 20.

House No. 11. Here are brought together many kinds of tropical plants belonging to the banana, ginger and canna families. The collection of bananas and their relatives occupies the greater part of the space and one or more of the specimens is usually in fruit; the collection contains both the edible, commercial bananas and the plantains, and also several species whose fruit is not edible, but in which the interest lies in their decorative leaves and flowers. The stems and leaves of all these plants contain some fiber, which is produced in enormous quantities in the Philippine Islands from *Musa textilis*, and is the well-known Manila hemp. The supply of fruit for the United States comes mostly from Central America and the West Indies, and some from northern South America. Bananas will grow in southern Florida, but the rocky soil of that region is not well adapted to their cultivation. The traveler's tree, from Madagascar, is shown in several fine specimens, and gets its English name from the fact that the axis of each long leaf-stalk contains a great deal of water which can be tapped and drunk. The bird-of-paradise plants, which take their name from their gaudy flowers, will be found in this group; they are natives of southern Africa and belong to the genus *Strelitzia*. Another genus of the banana family, *Bihai*, is also represented by several species, called wild plantains, natives mainly of tropical America.

Here also may be found several species of the genus *Costus* and of other genera of the ginger family, including the ginger plant (*Zingiber Zingiber*).

House No. 12 contains specimens illustrating several families of monocotyledonous plants of tropical regions. The

amaryllis family is represented by a number of species of the spider lily (*Hymenocallis*), bearing large white flowers, the commonest being *Hymenocallis expansa* from the sandy coasts of the West Indies; large plants of the genus *Crinum*, some of which have white flowers and some red or purple, may be seen here, and the maguey (*Furcraea*) of the West Indies (a spiny-leaved relative of the century plant, native of the West Indies, and used there for hedges); this name maguey is also applied in parts of the West Indies to species of *Agave*, which will be found in house 6.

Numerous representatives of the dracaena family, many of which are used for ornamental planting in the tropics, are in this house. Larger plants of this family will be found in house 13 adjoining. The collection of the genus *Sansevieria* is also located here; many species yield a tough and valuable fiber from the leaves; they are commonly referred to as bowstring-hemp.

The interesting screw-pines, natives of the Old World tropics, are illustrated by several species, the leaves of which are used in the manufacture of mats, hats and baskets. These plants are not at all related to pine trees, the latter part of the name referring to the slight resemblance the leaves bear to those of pineapple plants, which are commonly called *pines* in the tropics, while the remainder of the name was suggested by the spiral arrangement of the leaves. Larger specimens will be found in house 13 adjoining.

The tacca family, *Taccaceae*, is here represented in two genera, *Tacca cristata* and *Schizocapsa plantaginea*. This family is closely related to the amaryllis family.

The arrow-root family is illustrated by the arrow-root (*Maranta arundinacea*), native of South America, but widely cultivated in the West Indies, its roots furnishing the commercial product; *Calathea* comprises a large number of tropical American plants noteworthy for their fine foliage; and there are other genera represented.

House No. 13. This house contains largely temperate

palms, or other palms which will thrive under temperate conditions. Here is the dwarf fan palm (*Chamaerops humilis*), of the Mediterranean region; the genus *Howea*, native of Lord Howe's Island, and commonly known among florists as *Kentia*; the date palm (*Phoenix dactylifera*), of northern Africa, and other related species; the palmetto (*Sabal Palmetto*), of our southern states; and perhaps the most striking of all is the fan palm of the California desert (*Neowashingtonia robusta*), in four fine specimens. Large specimens of the screwpines (*Pandanus*), and of the genera *Dracaena* and *Cordyline* find a place here; smaller plants will be found in house 12 adjoining.

One of the most imposing plants here is *Araucaria Bidwillii*, a native of Australia, where it is known as bunga bunga; the members of the genus *Araucaria* replace in the southern hemisphere the pines of the northern. Other specimens of *Araucaria* will be found in the Central Display House at Range 2.

The gum-trees of Australia and Tasmania (*Eucalyptus*) are represented in two plants; these trees occur in large forests, and sometimes attain a height of 200 to 400 feet. There is also a specimen of the camphor tree (*Cinnamomum Camphora*), from which the camphor of commerce is derived. There is a tea-plant (*Thea sinensis*), the commercial plant from which is obtained our beverage tea; black and green tea are obtained from the same plant, the difference in color being due to the method of preparation; the tea-plant is extensively cultivated in many warm and tropical countries, having been used as a beverage by the Chinese from time immemorial; its first introduction into Europe is said to have been by the Dutch in 1610.

On the columns or against the walls will be found a number of vines. Among these is the yellow jessamine (*Gelsemium sempervirens*), of the south; it sends out its bright yellow flowers in February, and they persist for several weeks. Among others there are the following: Cherokee rose (*Rosa laevigata*); *Bougainvillaea* in two

COURT OF PUBLIC CONSERVATORY RANGE 1

species, the bracts surrounding the small flowers being bright magenta colored or red, making of the plant when in bloom a gorgeous show; the flaming bignonia (*Pyrostegia venusta*); the blue bignonia (*Clytostoma callistegioides*); and the large-flowered Solandra (*Solandra grandiflora*), a native of tropical America.

Houses Nos. 14 and 15. In these two houses are the smaller specimens of the palm family and Panama-hat-plant family, the larger plants being in house 1. On the north bench in house 14 is a collection of plants of the Panama-hat-plant family.

Conservatory Court

There are three attractive features here during the open season, viz., the display of tulips in the spring, followed by the collection of desert plants, and the water-lily collection. The water-lilies may be found in two pools, one in each end of the court. In the easterly one are placed the hardy sorts, such as are able to withstand the severe cold of our winters, which remain permanently where they are, winter and summer. In the westerly pool are the tender kinds, or such as require protection during the winter; many of these are stored in a warm place during winter and placed on view again in the spring. The most conspicuous of the tender sorts is the royal water-lily from Paraguay; this is not hardy in this climate, and, as it is too large to protect from the cold, is grown anew from seed each year; the seeds are sown in the propagating houses late in winter, and the young plants placed on view late in the spring or in early summer.

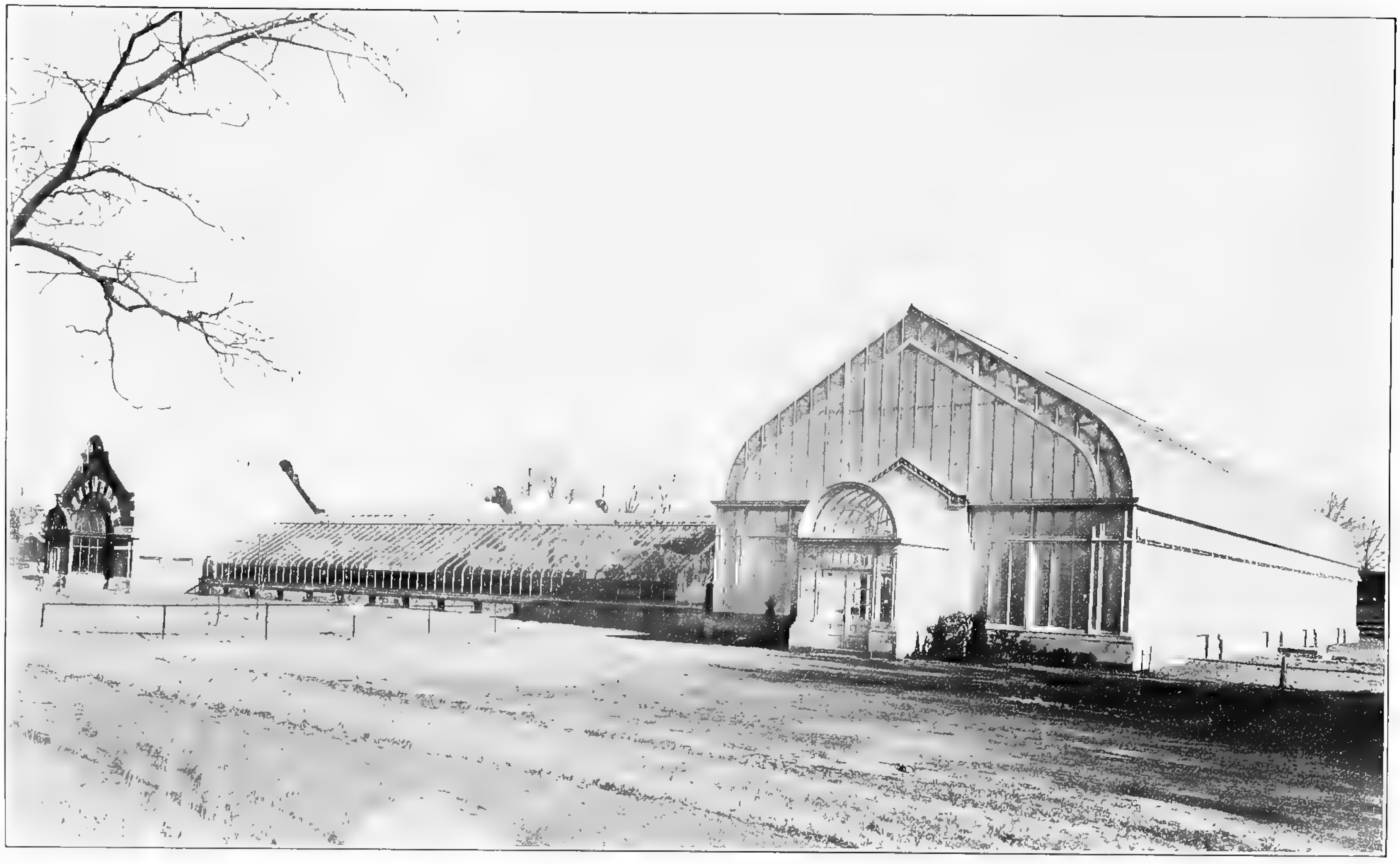
In summer the collection of desert plants is in the beds in front of the entrance to house No. 1, usually occupied by tulips during the spring. The central bed contains American desert plants only, made up largely of members of the cactus, amaryllis, and dracaena families. The bed paralleling this to the west contains a collection of

cacti, members of the genera *Nopalea* and *Opuntia*, the latter prickly pears, with flat stems or joints, all natives of the American desert. In a bed paralleling this on the opposite side of the central bed is a collection of desert plants from southern Africa. Placed transversely to this is a small bed with desert plants of one family, containing representatives from both the Old World and the New. A corresponding bed on the other side of the court is devoted to desert plants from the Old World. Near to this is a small bed containing plants of the genus *Opuntia*, those with round stems or joints and the tree-like forms. In the corresponding bed on the other side of the court is a collection of desert plants belonging to the spurge family.

3. Public Conservatory Range 2

This range is located on the easterly side of the grounds, a short distance from the Allerton Avenue Station of the Subway, and in the midst of the deciduous arboretum. Only the central transverse part and the houses north of it have been completed, consisting of the central display house, placed transversely to the long axis of the completed range; four lower houses, at a right angle to this, about 140 feet long, of which two are divided into two compartments each; and another section, about 156 feet long and 28 feet wide, parallel with the central display house and connected with it by the four lower houses above mentioned, and divided into three compartments. Connecting the long north and south houses are smaller houses, nos. 4, 8, and 12, used for potting and other preparatory purposes. The main entrance to this range is at the east end of the central display house.

In this range will be found the greater part of the collections of temperate plants, those which are not hardy in our climate but require cool cultural conditions; the collections of the orchid, pineapple, and fern families; the collection of cycads; the collection of pitcher plants; and some representatives of the arum family.



PUBLIC CONSERVATORY RANGE 2

VIEW IN CENTRAL DISPLAY HOUSE, CONSERVATORY RANGE 2

Central Display House.—This house, the gift of Messrs. Daniel and Murry Guggenheim, has a length of about 170 feet, a breadth of 47 feet, and a height of 35 feet. The central portion is designed for the purpose of giving

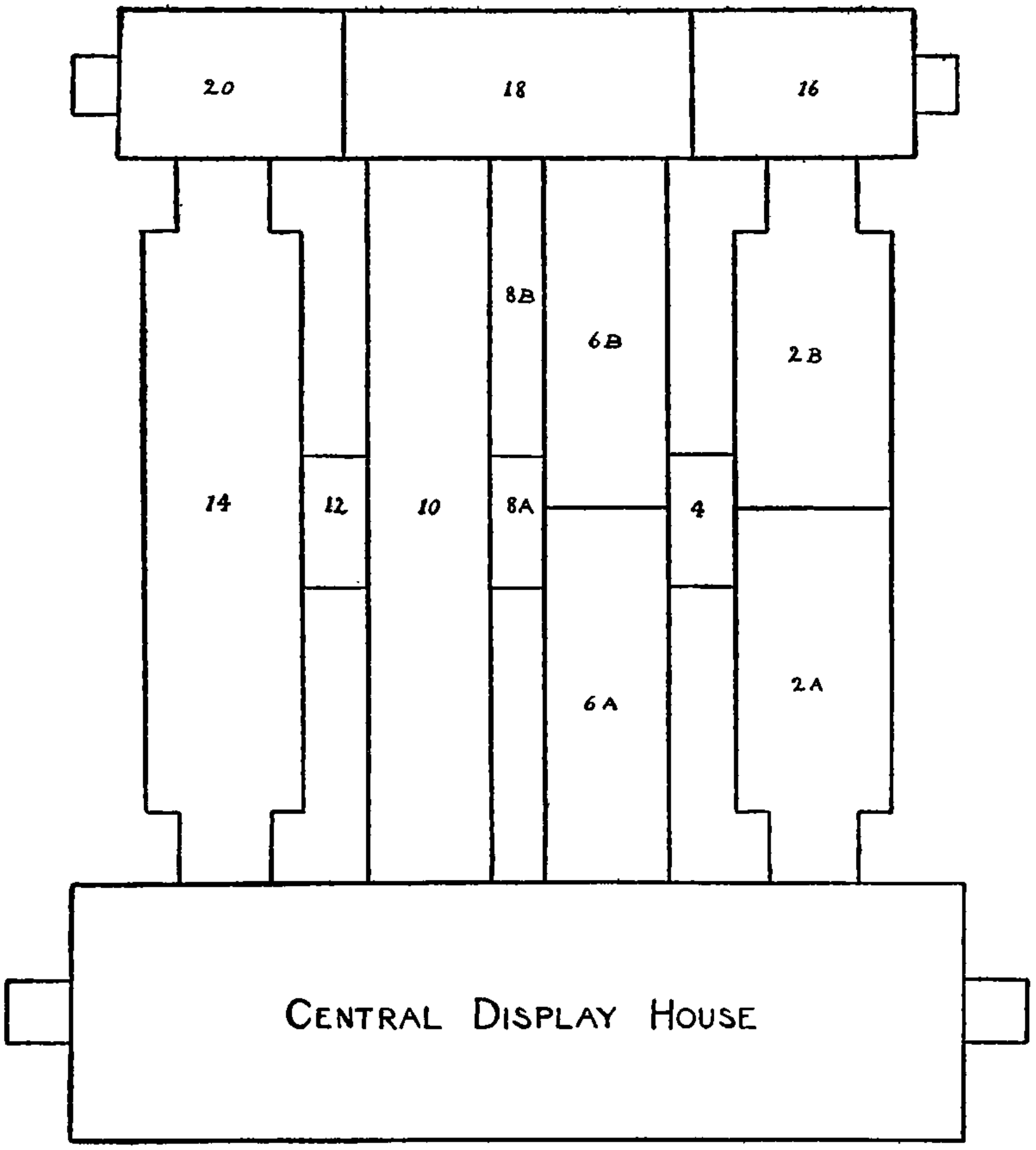


Fig. 2. Ground plan of Conservatory Range 2, so far as completed.

lectures on botanical and horticultural subjects, the large collections of living plants furnishing illustrative material. This portion is provided with a cement floor about 58 feet long and 47 feet wide. Flower shows may also be held here, the excellent light and the cool conditions maintained being well adapted to this purpose.

Here is being brought together a collection of temperate plants, natives of the warm temperate regions or of the higher mountainous portions of the tropics. Passing in through the main entrance, immediately in front will be found a group of acacias, mostly natives of Australia, although some few are of hybrid production. When in full bloom, which occurs usually from mid-winter to early spring, they are beautiful in their profusion of yellow blossoms. Back of this group is a miscellaneous collection, including a large specimen of *Podocarpus Purdieanus*, a native of Jamaica, and a large plant of *Araucaria Bidwillii*, the bunga bunga of Australia, its native country. At the other end of the house are groups comprising in part members of the pine family, such as *Araucaria*, *Juniperus*, and *Pinus*; there are also plants of the yew family, represented by *Podocarpus*, and a number of species of the myrtle family in the genera *Callistemon*, the bottle brush, *Myrtus*, the myrtle, *Eugenia*, and others. In this house is also a plant of the olive tree (*Olea europaea*), which is a native of the Mediterranean region and the Orient, but has now been largely introduced into cultivation in other warm countries; in the middle of the 18th century it was first introduced into California, at San Diego, it is said, and is now largely cultivated in southern California. Other interesting plants here are: the oleander, in the flowers, leaves, and especially the bark of which occurs a poisonous principle; the crepe myrtel (*Lagerstroemia indica*); the edible fig (*Ficus Carica*); and the pomegranate.

House No. 2. This house and compartment *B* of house 6 contain the orchid collections. The orchid family is widely distributed, occurring in all tropical regions, but finding its greatest development in the Old World in India and the Malayan region, while in the New World its greatest numbers occur in Brazil and other parts of northern South America. In temperate regions relatively few species are found, while in very cold countries they

are entirely absent. Most of the tropical forms are epiphytes, that is, they grow upon trees and usually have bulb-like or thickened stems and fleshy leaves for the conservation of their water supply, as, from their habitat, this supply must be precarious. In temperate regions nearly all of the species are terrestrial, and have thin leaves, the soil about their roots serving to protect them from the cold and also giving them a more constant water supply; they do not, therefore, need pseudobulbs or thickened stems. Coming from all parts of the world as they do, their blooming time varies greatly, so that at almost any time of the year, be it winter or summer, some of these interesting plants may be found in bloom.

This house is the gift of Messrs. Daniel and Murry Guggenheim. It has a length of 140 feet and a breadth of 29 feet. It is divided into two compartments, *A* and *B*.

In compartment *A* are the orchids requiring cool conditions. Here will be found: *Coelogyne cristata* and *Paphiopedilum insigne*, of the Himalayan region, the latter species with many color variations, and one of the exceptions in a genus usually requiring the conditions of a stove house; some species of the genus *Epidendrum; Lycaste*, an American genus; *Odontoglossum*, also of America; *Oncidium*, a large genus of tropical America, with a maximum development in South America; *Masdevallia*, in large part, a genus of great altitudes in the American tropics; *Pleurothallis*, with much the same distribution as the preceding genus, many of the species being very small, some only a half inch tall; and *Pleione*, of the Old World.

In compartment *B* are those requiring intermediate conditions as to temperature. Here, among others, will be found the genera: *Cattleya*, in most part, native of America only; *Epidendrum*, in part, also a large American group; *Laelia*, of American distribution; and *Oncidium*, in part, likewise American.

House No. 6. This house is the same length as house 2, but is only about 21 feet wide, and is a little lower. It is also divided into two compartments, *A* and *B*.

In compartment *A* is the collection of the pineapple family. These are mostly plants which live on the trunks and branches of trees in tropical forests, and are therefore called epiphytes, signifying plants growing upon other plants; many of them are exceedingly beautiful in foliage and in flower; the so-called Florida moss, or Spanish moss, clothes the trees of the live-oaks in the southern Atlantic States, and is not a moss at all, but a plant bearing small flowers which show its relationship to others of this family. The pineapple itself, doubtless the most familiar member of this group, has been cultivated in tropical regions for an indefinite period for fruit, and is not certainly known in the wild state; the pineapple fruit is the ripened bunch of flowers which forms at the top of the stem; the plant is propagated by cutting off the tuft of leaves, which is found on the top of the fruit, and by suckers which sprout from the side of the plant near the ground; it is an exception to the tree-loving habit of most of the family, in growing on the ground, and is cultivated in the Bahamas and on the Florida Keys, often in very rocky soil. One of the very spiny-leaved species, *Bromelia Pinguin*, is widely utilized as a hedge plant in the West Indies. Other genera to be found here are: *Tillandsia* and *Vriesia*, in many species; *Guzmania; Aechmea; Pitcairnia; Hohenbergia; Cryptanthus;* and *Billbergia.*

In compartment *B* are those which require very humid and hot conditions for their successful cultivation; such a house is called an East Indian or stove house. Here the larger and more interesting of the genera represented are: *Catasetum*, of American distribution; *Dendrobium*, a large group of the Old World; *Coelogyne*, of large representation, also in the Old World; *Paphiopedilum*, the Venus-slipper, an Old World representative of the group containing our lady-slippers, *Cypripedium; Peristeria elata*, of Panama, the Holy Ghost or dove orchid; *Vanda*, widely distributed in the East Indies and Malay Archipelago, many of them with large and showy, often sweet-scented, flowers; *An-*

graecum, of tropical Africa and the Mascarene Islands; and *Phalaenopsis*, native in the East Indies and the Malay Archipelago. Other plants requiring the conditions here are the tropical or East Indian pitcher-plants, *Nepenthes*, a collection of which will be found here. They are mostly vines, growing naturally on trees, their leaves curiously modified at the ends into hollow structures, provided with lids, and technically known as pitchers, which are often wrongly regarded as the flowers; these pitchers contain water and secrete from their sides a liquid which digests insects that fall or crawl into the pitchers; this form of nutriment is apparently not necessary at all, however, to the growth of the plants; the flowers are small but borne in large clusters arising from the stems and may often be seen in this collection.

House No. 10. In this house is a large part of the collection of tropical ferns and their allies, and a part of the collection of cycads. The larger specimens of ferns and the tree-ferns will be found in houses 18 and 20, and the larger cycad plants in house 16. This house is the same size as No. 6.

In so far as cultural conditions will permit, the ferns and their allies are arranged in families and genera, thus expressing relationships. The arrangement begins on the east side, as one enters from the central display house, and continues on and around the house, terminating on the west side opposite the point of starting. Among the larger fern genera here represented are: the maidenhair ferns, *Adiantum*; the polypodies, *Polypodium*, and a few related genera; the brakes, *Pteris*; the shield-ferns, *Polystichum* and *Dryopteris*; the spleenworts, *Asplenium;* and the Boston fern and its relatives, derived from *Nephrolepis exaltata*, a tropical species—an interesting group, showing the great diversity in forms which may result from a single species by selection and propagation. A large group, related to the ferns, is the selaginella family, represented by many species; this family is largely tropical, a

comparatively small number of species being found in temperate regions, a few of which are in North America. *Psilotum nudum* is another plant related to the ferns, and of rather rare occurrence in cultivation.

At the south end of the center bench is a part of the cycad collection. *Microcycas calocoma*, a rare Cuban plant, is among these. There are a number of specimens of the American genus *Zamia*, including representatives from Florida and the West Indies.

House No. 14. The plants in this house, which is the same size as No. 2, are natives of warm temperate regions, or of the greater altitudes in the tropics; they are not hardy in our climate. The larger specimens of the temperate collections will be found in the Central Display House.

The plants here are arranged in sequence of families as far as cultural conditions will permit, thus furnishing a collection for the comparative study of plant families and genera. The sequence begins on the right hand, as one enters from the Central Display House, and continues on and around this house, terminating on the west bench opposite the point of starting. First come the temperate ferns and their allies, and the members of the pine and yew families. Then follow the endogenous plants, those which are typified by the common lily, the grass, and the palm. Following these, and forming the greater part of the collection, are the exogenous plants, those with net-veined leaves. Two curious plants among the endogens are members of the lily-of-the-valley family; they are the butcher's broom (*Ruscus aculeatus*), and the double-tongue (*Ruscus Hypoglossum*). The iris family, to which belong the flags, is represented by an example from Bermuda, known as the Bermuda iris (*Sisyrinchium Bermudiana*); to this genus belong the blue-eyed grasses of the United States. The amaryllis family has as a representative a yellow star grass (*Hypoxis villosa*) from southern Africa, much resembling the species found wild in the eastern United States. A few specimens of *Paphiopedilum insigne* are

placed here, in order to show the relationship of the orchid family to the other endogenous ones. Curious among the exogenous plants is the horsetail knotweed (*Polygonum equisetiforme*), of southern Europe. Others of curious interest are the pitcher-plants (*Sarracenia*), of the south-eastern United States. The pitchers contain a liquid in which the insects are drowned, the fluid resulting through their decay being absorbed by the pitchers; these structures form a part of the leaves and are a modification of the petiole. The sundews (*Drosera*) are also insectivorous plants; they secrete a sticky substance from the glandular hairs on their leaves, which can digest insects and other animal matter. A plant useful as a ground cover in a temperate house is *Helxine Soleirolii*, a member of the nettle family. It grows rapidly and soon forms a beautiful carpet of green.

House No. 16. This house is about 28 feet wide and 43 feet long. Here is a collection of sago palms or cycads; others will be found on the south end of the center bench in house 10. This family of plants is represented by large specimens of *Cycas revoluta*, from Japan; *Cycas circinalis*, from the Molucca Islands; a single plant of the rare *Stangeria eriopus*, from southern Africa, where it is known as the kaffir's-head; the American genus, *Ceratozamia*, named on account of the horns on the scales of the cone—*Ceratozamia mexicana* and *Ceratozamia Miqueliana*, both from Mexico, are in the collection; a number of specimens of the genus *Zamia*, including the small Florida coonties; the kaffir-bread (*Encephalartos*), from Africa; *Macrozamia Moorei*, from Australia; and the Mexican genus *Dioön*. The stems and trunks of plants of this family contain much starch, which is extracted, in the countries in which they grow, by crushing and washing, and passes into commerce under the name of sago starch. On the walls are specimens of aroid vines.

House No. 18. This house is about 68 feet long; it contains a part of the collection of tree-ferns, specimens of

other ferns too large for house 10, and the main collection of staghorn ferns, which are hanging from the roof. Specimens of aroid vines will also be found on the walls.

The graceful tree-ferns inhabit mostly the mountains of the tropics, commonly at an elevation of 1500 feet or more. Some of the plants have been secured by Garden expeditions to different parts of the American tropics. Suspended from the roof, in addition to the staghorn ferns, are other desirable ferns.

House No. 20. This is the same size as house 16. It contains tree-ferns, and large specimens of other ferns, including some of *Blechnum brasiliense*. Here is a fern from China and Tartary, known as the Scythian Lamb (*Cibotium Barometz*), which is of interest as forming the basis of a marvellous tale, current in early times, to the effect that on a vast plain to the eastward of the Volga occurred a wonderful plant, looking like a lamb. This animal, so the story ran, was supported upon a stalk and as soon as it had exhausted the vegetation at hand died from starvation. There are also climbing ferns in this house. Aroid vines will be found on the walls.

Power Houses

Steam for heating conservatory range 1 is supplied from the power house, located near the New York Central Railroad just south of the 200th Street entrance and connected with the range by a subway about six hundred feet long containing the steam mains; five boilers are installed and supply steam not only to the range, but also to the museum building through another subway about twelve hundred feet in length.

Steam for heating conservatory range 2 is supplied from a boiler house near this structure, a little to the north.

4. The Mansion

This large stone house, situated on the high eastern bank of the Bronx River above the waterfall, came to the use

THE MANSION

VIEW IN THE PINETUM, THE MUSEUM BUILDING IN THE DISTANCE

of the Garden with the tract of about 140 acres added by the city to the reservation in 1915. At that time it was much out of repair, but considerable work has since been done upon it. The basement is used for shops for storage; the Bronx Society of Arts and Sciences has occupied a part of the building for several years, having museum collections on both the first and second floors as well as the use of a room for its Secretary; the Horticultural Society of New York has been given office room on the second floor; some of the laboratories of the Garden are located here; and part of the first floor has been fitted up for board rooms and a lecture room.

5. The Pinetum

[COLLECTION OF CONE-BEARING TREES]

The collection of cone-bearing trees, technically known as the Pinetum, because the pines are the most abundant of these trees, is planted over a space of about 30 acres in the southwestern part of the grounds, extending from the approach to the elevated railway station southeast to the herbaceous garden, and northeast to the museum building and the borders of the hemlock forest. The species of trees are grouped in genera, which are mostly separated by paths. The planting out of these trees was commenced in 1901; the collection will continually become more complete year by year as additional species are secured; many of these have to be raised from seed, and the process of establishing a collection of conifers thus requires much time.

Commencing at the approach to the elevated railway station we find the Douglas spruce (*Pseudotsuga mucronata*) planted in the space between the traffic road and the park driveway to the left of the path leading to the conservatories; this tree is a native of western North America from the Rocky Mountains to the Pacific Coast and is sometimes known as red fir; in the far northwest it sometimes becomes 180 to 210 feet high, its trunk occasionally as much as 14 feet in diameter, but in the Rocky Mountains it is

seldom one-half this size, and trees taken from the far northwest do not thrive well on the Atlantic coast, owing to the much greater rainfall which they naturally receive there; the cones of the Douglas spruce are from 2 to 4 inches long, pendant on the branches, their scales rounded and shorter than the bracts which project beyond them.

The hemlock spruces (*Tsuga*) are planted south of power house 1, and are represented by the Canadian hemlock spruce (*Tsuga canadensis*), the same species which forms the interesting forest on the hills bordering the Bronx River, and indicated on the general plan of the Garden as the hemlock grove. This tree occasionally becomes 100 feet high, with a trunk up to 4 feet in diameter, and is distributed throughout northeastern North America, extending southward along the mountains to Alabama, northward to Nova Scotia and westward to Minnesota. Its bark is the most important tanning substance in the United States and a great many trees are annually felled to obtain it; its wood furnishes a cheap lumber of little strength and durability. The weeping hemlock (*Tsuga canadensis pendula*) is one of the most beautiful dwarf evergreens. The Carolina hemlock (*Tsuga caroliniana*), from the mountains of southern Virginia to Georgia, may also be seen here, as well as Siebold's hemlock spruce (*Tsuga Tsuga*), to which the name *Tsuga* was first applied. The hairy-twigged Japanese hemlock, *Tsuga diversifolia*, is also here.

In the area to the westward of the conservatories, extending to the west border, and bounded by paths on the north and south, are the firs (*Abies*). These can at once be distinguished from the spruces (*Picea*) by the erect, instead of pendulous, cones, and by the smooth branchlets. The wood of the firs is usually soft and not durable, so it makes poor lumber. Specimens of the balsam fir will be found here; this is widely distributed over northern North America, and from it is obtained canada balsam or balm of fir, used in the arts and in medicine. The Japanese silver fir is an attractive plant, with its dark green stiff foliage.

Veitch's silver fir, from Japan, and said also to occur on the neighboring coast of Manchuria, is useful for ornamental purposes; it was discovered in 1860 on the famous Japanese mountain, Fuji-yama, by Mr. Veitch, for whom it is named. The red fir, from Washington and Oregon, with its blue leaves, borne almost erect and apparently on but one side of the branchlets, makes a conspicuous object; in its native country it sometimes attains a height of 250 feet but here is of very slow growth, as evidenced by the plants in the pinetum which are about 20 years old; its wood is sometimes used in the interior finishing of buildings. Among other firs here are: the white fir, from western North America, sometimes growing to a height of 200 to 250 feet; the Siberian fir, from northern Europe and Asia, yielding a soft lumber in general use and a bark used in tanning leather; the silver fir, from Europe; Nordmann's silver fir, from the Caucasus; the Cilician fir, from Asia Minor; and the Nikko silver fir, from Japan.

The spruces (*Picea*) are located in the area to the northeast of the firs. Some of the spruces are most valuable timber trees. The oriental spruce, from western Asia and the Caucasus, is present in several specimens. One of the hardiest spruces for our climate, and a general favorite, is the Colorado spruce, which sometimes becomes 100 feet tall in its native country; this will be found here in the green form; also in the varieties *glauca* and *Kosteri*, the blue color of the young leaves more marked in the latter, and a pendulous form of variety *glauca*. The Norway spruce and a number of horticultural forms are brought together to the west of the group of golden bells or Forsythia near the Garden station plaza; it is a commonly cultivated tree and furnishes a useful timber, which is known as "white deal" in England, and is largely used in the manufacture of musical instruments; the resinous exudation of this tree is known as Burgundy pitch, which, in combination with other ingredients, is used in Europe to line beer casks. Other spruces of interest here are the Yesso spruce, the

wood of which is much used in Japan; Engelmann's spruce, from western North America, the wood of which is largely manufactured into lumber and the bark sometimes used in tanning; the Servian spruce, one of the largest and most valuable timber trees of southeastern Europe; and the tiger-tail spruce, from Japan, introduced about forty years ago, one of the hardiest Asiatic species in cultivation.

The space allotted to the pines (*Pinus*) embraces the region to the eastward of the spruces and public conservatory, range 1, extending across the road to the herbaceous grounds. Most of the pines are of great economic importance, furnishing large quantities of lumber, turpentine and resin. Many of the white pines will be found on the westerly ridge of the herbaceous grounds and across the road from this to the eastward of range 1. Among these is our common white pine, which is perhaps the most valuable of the timber trees of northeastern North America, large quantities of lumber being derived from it. Near this is the Himalayan white pine, resembling it, but with longer drooping leaves and the cones borne on long stalks; this sometimes attains a height of 150 feet in its native country, where its lumber is much used for building and other purposes. In this region will also be found the white Swiss stone pine, of Europe and Asia; and the Macedonian white pine, of southeastern Europe.

In the area to the eastward of range 1 will be found, among others, the Austrian pine, with a hard, strong wood which is much used; the variegated Scotch pine, with the young leaves variegated; and a number of plants of the white pine, Himalayan white pine and the Rocky Mountain, western, and Korean white pines.

In the region to the north of the white pine tract, and on the westerly side of the herbaceous grounds ridge, will be found the Japanese red pine, and several horticultural forms of it. Following these to the north are a number of plants of the Jack or gray pine, native of northern North

America; its wood is sometimes used for fuel, and was valued by the Indians for the frames of canoes.

In the area to the eastward of the spruces are a number of other pines. The Korean white pine, a native of eastern Asia, is located next to the spruces. Near this is the Table-mountain pine. On the high ground to the eastward of the above is the Scotch pine, the principal timber pine of Europe and Asiatic Russia. On the easterly slope of this higher land and on the lower ground nearby may be found, among others, the red or Norway pine, from northeastern North America, the wood of which is largely used for building purposes and for masts, piles and spars; the small-flowered white pine, from Japan, where it is frequently used by the Japanese in producing their miniature trees; the Japanese black pine, useful for its wood; the Austrian pine, found native from Austria to the Balkan peninsula; and the yellow, or bull, pine, from western North America.

In the triangle located midway between the south gate and range 1, are the American cypresses (*Taxodium*), in two species: the bald cypress, and the pond cypress. These, like the larches (*Larix*), and a few other coniferous trees, shed their leaves for a portion of the year. They form vast areas in parts of the southern states, called cypress swamps. Their timber is of economic importance and their bark is rich in tannin. None of the true cypresses (*Cupressus*) are hardy with us.

At the northern end of the swale in which the herbaceous grounds are located, and to the westward of the morphologic garden, is the collection of larches (*Larix*) and also the members of the yew family (Taxaceae). The larches are deciduous trees, the wood of which is of great economic importance. Specimens of the European larch are here, and also of the Japanese larch. The genus *Pseudolarix*, distinguished from the larches in having the scales of the cones decidous, is represented by its single species, the golden or Chinese larch; this, like the true larches, is a deciduous tree.

The yew family (Taxaceae) is represented by three genera. Of the true yews (*Taxus*) there are: the American yew, or ground hemlock; the English yew and several of its horticultural varieties, the wood of which was highly prized in ancient times for the manufacture of bows; and the Japanese yew. The last is by far the best for this climate, standing well the dry summers and cold winters; there is a dwarf form of this known as variety *nana*, which is an especially desirable evergreen for decorative planting. The cluster-flowered yew (*Cephalotaxus*) is represented by two from China and Japan. The Japanese Torreya (*Tumion nuciferum*) represents this genus. Another species, *Tumion taxifolium*, of Florida, is not hardy in our climate; it will be found in house 14, conservatory range 2. Still other representatives of the yew family are in the central display house and house 14 of conservatory range 2.

To the north of the economic garden will be found specimens of the umbrella pine, not a true pine, however, but belonging to the genus *Sciadopitys*, a native of Japan. Another tree here is the Japanese cedar, *Cryptomeria japonica*, with several horticultural varieties; this will stand our winter climate only in sheltered situations such as this; the variety *Lobbii* is more hardy and therefore better suited to this climate.

On the westerly corner of the conservatory terrace and in the immediate vicinity are located the retinisporas, which are so commonly cultivated as decorative plants. There are many horticultural forms here represented, but they are all variations of two Japanese trees: the Sawara cypress (*Chamaecyparis pisifera*); and the Hinoki cypress (*Chamaecyparis obtusa*). The latter species is frequently used by the Japanese in their dwarfing process. The names borne by the various horticultural forms have been suggested by some peculiarity in coloring or in manner of growth. North American species of the genus *Chamaecyparis* will be found in the low ground along the south walk, not far from the south gate.

On the easterly corner of the conservatory terrace, opposite the retinisporas, is a part of the juniper, or red cedar (*Juniperus*), collection. The remaining and larger portion of this collection will be found on the easterly end of the area lying between the driveway and the traffic-road south of range 1. In these two areas will be found many species and varieties of these plants. The common juniper, of north temperate regions, is one of these; also the Irish juniper, a form of this, of compact and strict habit. The red cedar, so common in a wild state in the grounds of the Garden, finds representatives in many horticultural forms. The savin juniper, of Europe and northern Asia, and its American representative, the Waukegan juniper, of northern North America, are both neat low-growing sorts. The Chinese juniper, and its striking form, of columnar habit, known as variety *pyramidalis*, are each present in a number of specimens. There are still other varities of the Chinese juniper represented here, including *Pfitzeriana*, one of the best dwarf conifers.

At the westerly end of this area is the arbor vitae group (*Thuja*). The species of this genus produce a durable wood which is of especial value where there is contact with the soil. The Japanese arbor vitae is represented by several specimens. The common arbor vitae, from northeastern North America, is fully represented, not only by the typical form, but by many horticultural varieties, some of them very decorative; the wood of this tree is valued for fence posts, railway ties, etc., and from its young branches fluid extracts and tinctures are made which are used in medicine. The Chinese arbor vitae, from China and Japan, has a number of specimens representing it and some of its horticultural forms; this as a decorative plant in this vicinity is not satisfactory, as it is not quite hardy, the branches often killing back in the winter and the foliage burning badly.

The maiden-hair tree family (Ginkgoaceae) is represented by a single species, the maiden-hair tree, several specimens

of which may be found on the southern portion of the westerly ridge of the herbaceous grounds. This interesting tree, with its fan-shaped leaves, is a remarkable relic of a type of vegetation which was common and widely distributed in tertiary geologic time, but is now restricted to eastern temperate Asia in this one species, *Ginkgo biloba*.

Plantations of Young Conifers

The young white pine forest, established in the spring of 1916 on the rocky hill north of the iris garden, in cooperation with the State Conservation Commission through the interest of Dr. Walter B. James and the Honorable George D. Pratt, has continued to develop satisfactorily, and is of great interest as a demonstration of forest establishment. It has been carefully protected from fire by keeping the grass cut short in the autumn, and each young pine has been mulched with a small amount of leaf mold.

Through the further interest of the State Conservation Commission and of Dr. James, a new plantation of the red pine (*Pinus resinosa*) was made in the spring of 1918 on the rocky ridge opposite Fordham Hospital, nearly 2,000 four-year-old transplants being furnished by the Commission at a nominal cost. It happened that planting conditions were so good that nearly every pine grew, and this plantation has also been of exceptional interest.

A small plantation of the white fir (*Abies concolor*), a native of the west, has also been installed nearby, adjoining the beds of cannas in the horticultural collections.

The Victory Grove of 150 Douglas spruces (*Pseudotsuga mucronata*), also natives of western America, is located near the beds of gladioli in the same area. The trees were already about five feet high when planted in the spring of 1919 as war memorials.

6. The Deciduous Arboretum

This plantation extends over much of the garden area east of the Bronx River. The sequence of plant families

VIEW IN THE DECIDUOUS ARBORETUM

begins at the southeast corner of the grounds and continues northward to the northern boundary, occupying the easterly ridge and the low grounds adjacent thereto. Here hardy trees are brought together, trees being regarded as woody plants which have a single main stem arising from the ground and not branching until some distance above it. The groups will be referred to in the order of their sequence.

The first is the willow family which occupies the land south of the nursery, where a collection of willows and poplars may be found. Of these Simon's balsam poplar, native from the Amur valley to China, is of rapid growth and upright habit, and more graceful than the cottonwood or Carolina poplar; the American aspen, a native of northern North America, the wood of which is largely manufactured into pulp for the making of paper; in northern British America it is the principal fuel of the Indians, as it burns freely when green and without sparks; the inner bark, which is sweet, is often used by them as a food in early spring. This tree has been of great service in re-foresting large tracts which have been denuded by fire; the long hairy appendages to the seeds enable the wind to carry them far and wide, and as they germinate quickly and the young seedlings grow rapidly in exposed situations, it is admirably adapted to the above purpose, quickly furnishing a covering for the land until more desirable trees may get a foothold. The white or silver-leaf poplar, of Europe and Asia, and Bolle's poplar, a variety of this with lobed leaves and quite ornamental, are here. There also is the Lombardy, or Italian poplar, from Europe, with its tall spire-like growth. Among the willows are the white willow, from Europe and Asia, and the weeping willow, native of southeastern Europe and Asia, a tree commonly planted for ornamental purposes, and sometimes known as Napoleon's willow. An additional area to the south, east of the long lake, is now being developed for the willow family and the walnut family.

The walnuts and their relatives may be found in the region to the north of the willow family. The narrow-winged wing-nut, from China, is here. Of the walnuts (*Juglans*), the English Walnut, native from southeastern Europe to China, produces a most desirable nut, often called Madeira nut; the Romans introduced it into Italy, and from that place as a center its cultivation has spread in all directions, both in the Old World and the New; the nuts form a common article of food in southern Europe; in Europe and northern India an oil, called walnut-oil, used as a substitute for olive-oil, is obtained by subjecting the seed-leaves to pressure. The black walnut and the butternut are both wild elsewhere in the Garden, and are also represented here by small trees. The pecan-nut (*Hicoria Pecan*), wild in the southeastern United States, is another nut of popular favor, as is also the big shell-bark or king-nut, of the eastern United States. The water hickory, of the southeastern United States, and the bitter-nut or swamp hickory, of the eastern United States, are both represented, while the common shag-bark hickory and the pig-nut grow elsewhere in the grounds.

The birch family is located along the driveway, west and south of the stable, where birches, alders and horn-beams are planted; the European hornbeam is represented. The American hornbeam is common in Bronx Park, and the hop-hornbeam is occasional. Those desiring to study the birches (*Betula*) will find several species available; one of these is the yellow birch which grows wild in eastern North America, and is one of our most valuable timber trees; the wood, on account of its closeness of grain, strength and hardness, is suitable for many purposes. Another is the paper, or canoe, birch, of frequent occurrence in northern North America; the wood of this is preferred to that of any other tree for the manufacture of spools, and is also used in the manufacture of shoe-lasts and pegs; the Indians also make use of its wood in the manufacture of sledges, and from its tough bark they make canoes and baskets.

The river, or red, birch may be seen here; it is frequent along streams and lakes in the eastern parts of the United States; its wood is used in the manufacture of furniture. The black, or cherry, birch is in the collection, and this and the poplar-leaved birch are wild elsewhere in the Garden. There is also the European white birch and some of its varieties, the southern yellow birch, and others. The alders are present in several species: the dye alder, of Japan, which becomes a large tree; the Japanese alder, also of Japan; the speckled or hoary alder, of north temperate regions; and the European alder.

The area devoted to the beech family lies to the westward of that assigned to the birch family; the oaks, the chestnuts and the beeches belong here. The oaks (*Quercus*) are represented by many species. One of these is the rock chestnut oak, of the northeastern United States; its wood is strong and durable, especially when in contact with the soil, and is therefore of great value for railroad ties and fence posts, and its bark is largely used for tanning. The mossy-cup or bur oak, of eastern North America, may be found here; this was discovered by the botanist Michaux in 1795, and is a valuable timber tree, its wood largely used for boat-building, for the manufacture of carriages and agricultural implements, for the interior finish of houses, and, on account of its durability in contact with the soil, for railroad ties. The red oak and the swamp white oak are natives of eastern North America; the latter is also a good timber tree, its wood being used for cabinet work and in various kinds of construction. The saw-toothed oak forms a part of this collection; its leaves are much like those of the chestnut, and might easily be mistaken for them; it is often planted in Japan in the silk districts, as its leaves are available as food for the silkworms; the Japanese make charcoal from its wood, and from the bark they extract a black dye. The post, or iron, oak is a native of the eastern United States. Here may be seen also the English oak, a native of Europe and western

Asia. The large-toothed oak, of Japan, a valued timber tree there, is represented nearby; as is also the gland-bearing oak, another Japanese species. The shingle, or laurel oak, of the eastern United States, is not of much commercial value, as its wood checks badly in drying; it is sometimes used in making clapboards and shingles. Schneck's oak comes from the south central parts of the United States. The Turkey oak, of southeastern Europe and western Asia, is valued in that region on account of its bark which is used in tanning leather. Several hybrid oaks form interesting parts of the collection. The pin oak, the scarlet oak, the black oak and the white oak are to be seen in large wild specimens elsewhere in the grounds.

The chestnuts (*Castanea*) are represented by the Japanese chestnut, of China and Japan. The American chestnut was in former years common about the grounds, some of the trees being large and of great age. The chestnut blight has destroyed or necessitated the destruction of all of these trees. The beeches (*Fagus*) are located in the north part of the swale at the west side of the oak family reservation. The European beech and its purple-leaved variety may both be found here in small, recently planted trees; there are large specimens of the purple-leaved and weeping varieties of this south of the mansion. Small trees of the American beech are also here, but large wild specimens may be found along the driveways and paths in the vicinity; the wood of the beech takes a high polish and is largely used for furniture, while the nuts are edible. The uses of the European beech are about the same as those of the American.

The elm family, to which belong the elms, the hack-berries or sugarberries, and the water-elms, is located on the ridge to the north of the stable. Among the elms (*Ulmus*) to be found here is the Scotch or Wych elm, native from Europe to Japan; the red elm, growing wild from Tennessee to Alabama; the cork or rock elm, of northeastern North America; the Chinese elm, of China and Japan; and the

winged elm or wahoo, of the southeastern United States. The American elm and the slippery elm are wild in the grounds. The hackberries (*Celtis*) represented are the Georgia hackberry, the dog hackberry, and Small's hackberry, of the southeastern United States; and the nettle-tree, or sugarberry, of eastern North America. The water-elms are illustrated by the sharp-pointed water-elm, or *Zelkova*, a native of Japan. The mulberry family (Moraceae) is represented by the osage orange (*Toxylon*), a native of the south central parts of the United States, trees of which may be found to the south of the drive-way from the long bridge; and by the Russian red and white mulberries. The kadsura tree family has for its representatives the kadsura tree, of Japan, and the elm-leaved eucommia, of China, located just to the south of the row of large tulip trees east of the Bronx River.

The magnolia collection is planted on the west and south sides of the swale between the two ridges. The long-leaved umbrella tree is one of those to be seen here; it is a native of the mountain woods from Virginia to Florida and Mississippi. The cucumber tree, the white-leaved Japanese magnolia, the umbrella tree, and a number of hybrid forms are other magnolias to be looked for here. Large specimens of the umbrella tree and of the large-leaved umbrella tree will be found at the north end of the herbaceous grounds, on the west side; and still other species at the fruticetum. The tulip-tree is shown by a row of fine wild specimens just to the south of the long bridge over the Bronx River, the largest trees within the grounds of the Garden. This tree is native of the eastern United States and yields a valuable lumber known as yellow poplar or white-wood; the Indians formerly made their canoes from this wood. Four parallel rows of this tree form part of the approach to the museum building. Related to the magnolias is the custard-apple family, represented by two specimens of the North American papaw, which will be found at the herbaceous grounds on the west side, near

the north end; this is a native of the eastern part of the country, from Ontario and New York to Michigan, Nebraska, Florida and Texas. Other tropical representatives of this family will be found in house 2, conservatory range 1. The laurel family is represented by the sassafras, many trees of which may be found wild in various parts of the Garden. The sweet gum (*Liquidambar*), also wild in the grounds, represents the witch-hazel family.

The plane-trees are to be found just to the west of the elms. Here are specimens of the American plane-tree; it is a native of the eastern United States. On a knoll nearby is a large specimen, native to the grounds, of this tree, which is also known as the button-wood and button-ball, and there are many other wild trees along the Bronx River. Specimens of the London plane will also be found here. This is largely planted as a shade tree in Europe, and is often used in this country for the same purpose. It is commonly known and sold as the oriental plane, but it is not that tree, but a hybrid of horticultural origin. The wood of the American plane, or button-wood, is largely used in the manufacture of boxes for tobacco, for furniture, and for the interior finishing of houses.

The apple family and the peach family are located to the north of the driveway leading to the long bridge. In the apple family may be found some of the tree hawthorns and thorns, including the Washington thorn, a native of the southeastern United States. Following to the west are some of the true apples (*Malus*), among them the Siberian crab-apple, a native of eastern Asia; the cherry-leaved crab-apple, presumably a natural hybrid, originally from Siberia; the American crab-apple, from the eastern United States; and Soulard's crab-apple, from the central United States. In the peach family, among others, may be found the rose-bud cherry, a Japanese plant, and a highly decorative species; and the ordinary sweet cherry, originally from Europe, a delicious fruit, of which there are many horticultural forms.

Along the path in the little swale running to the west is a collection of the Japanese flowering cherries which are so highly admired by the Japanese, and this admiration is shared by all who see these specimens at the height of their loveliness which comes about the last week in April or the first in May. There are about one hundred trees in the collection, the blossoms from single to double, and the colors ranging from white to the deepest rose, and one with the blossoms a yellowish green, quite in contrast with the remainder. There is also in this collection a group, occupying the point dividing the paths, of the Japanese weeping cherry; this blossoms two or three weeks earlier than the others; its long drooping branches, clothed with delicate pink blossoms, make of it a graceful and charming object.

Near the eastern end of the long bridge are trees illustrating the senna family, located south of the bridge approach, and the pea family, the rue family and the mahogany family on the north side. One of those in the senna family is the honey-locust or three-horned acacia (*Gleditsia*), a native of eastern North America; its durability when in contact with the ground makes its wood of especial value for fence posts, for which purpose it is largely used. Another of this family is the Kentucky coffee-tree, in several large and small specimens. One of the representatives of the pea family, from Japan, is the Japanese yellow-wood (*Maackia*). Another is the locust-tree (*Robinia*), a native of the south central United States, but extensively naturalized elsewhere; its wood is hard and close-grained, and is very durable when in contact with ground or with water, so the high value in which it is held for fence posts and for ship-building may be readily understood. The rue family has for representatives the Japanese cork-tree (*Phellodendron*), from central Japan, and the Asiatic or Sachalin cork-tree, from northeastern Asia. The mahogany-tree family has a single species represented, the Chinese bastard-cedar, a native of northern China; the mahogany tree itself, and other representatives of the family, will be found at conservatory range 1.

On the ridge to the northeast of the apple family, and to the west of conservatory range 2, are trees of the ailanthus family, represented by the *Ailanthus*, or tree-of-heaven, a native of China, but extensively naturalized in the eastern parts of the United States, where in some places it has become a nuisance, both on account of its ill-smelling staminate flowers and its habit of freely suckering from the roots.

On the ridge to the west of conservatory range 2 are representatives of the maple family. The maples (*Acer*) are represented by a number of species. Perhaps the most important of these is the sugar, or rock maple, a native of eastern North America, and the principal tree yielding maple sugar and syrup. The sap is usually collected from late in February to early in April; trees from twenty to thirty years old are considered the most productive, and a tree will usually yield in a season from four to six pounds of sugar, some giving less and others much more. This tree is often planted for shade along streets and in parks, its beautiful coloring in the fall enhancing its value for this purpose. Its wood is largely used for making furniture, in ship-building, for tool-handles and for shoe-lasts and pegs. From the southeastern United States comes the white-barked sugar maple, also in the collection. Another tree here is the red maple, ranging throughout eastern North America; its wood is now used in large quantities for the manufacture of furniture of various kinds, for gun-stocks, etc. The striped, or goose-foot, maple, sometimes known also as moosewood, of eastern North America, is a pretty, decorative species, especially attractive on account of the beautiful marking of its bark. The box-elder, or ash-leaved maple, native of eastern North America, represents another type with compound leaves. Three Old World representatives are the common European maple, of Europe and western Asia; the sycamore maple, from Europe and the Caucasus; and the Norway maple, with a number of varieties, also from Europe and the Caucasus.

The sycamore maple is a valuable timber tree in Europe; its wood is used in the manufacture of musical instruments, spoons and other household utensils. Other maples are at the fruticetum. Farther north on this ridge may be seen young trees of *Koelreuteria*, the varnish tree, native of China, Korea, and Japan.

In the buckeye family, planted north of conservatory range 2, is the common horse-chestnut (*Aesculus*); for a long time the native country of this tree was unknown, and its home was ascribed by different authors to various lands; it has been pretty well established now that it is indigenous to the mountains of northern Greece and Bulgaria. Another tree here is the fetid or Ohio buckeye, of the south central United States; its wood, as well as that of some of the other kinds of buckeye, is manufactured into artificial limbs, for which purpose it is highly esteemed; it is also used for wooden-ware and paper pulp. To the north of the buckeye family is the linden family. The American linden or basswood, found over the eastern parts of North America, is here; it produces a large amount of lumber under the name of whitewood, which is used in the manufacture of wooden-ware, furniture, and carriage bodies; it is also largely used in the manufacture of paper pulp. Other species are the white or silver linden, of eastern Europe and Asia Minor, and the common European lindens.

Next in the sequence comes the oleaster family, represented by the oleaster, a native of southeastern Europe and western Asia. Then follows the ginseng family, represented by several species of aralia, while others will be found at the fruticetum; many other species of this family may be found at the conservatories. West of these is the ebony family, represented by the persimmon or date-plum (*Diospyros*), a native of the southeastern United States; its wood is preferred for the manufacture of shuttles; its fruit contains tannin, which gives it its astringent properties; this fruit, when fully ripe, is eaten in large

quantities in the southern states, and is also offered for sale in the markets of the north. Larger trees will be found along the driveway east of the museum.

Farther down the hill, west of the persimmon group, is a collection of the flowering dogwood, *Cynoxylon floridum*, both the form with white flower bracts and that with red; the former being common in the woodlands. Another representative of the dogwood family is the sour gum (*Nyssa*), of eastern North America; it occurs wild in the Garden in many fine specimens.

Beyond the ginseng family, on the western slope of the hill, is the olive family, represented by many species of the ash (*Fraxinus*), some of which are useful for timber. The common European ash is to be seen, and among the North American representatives are the green ash; the Texas ash, restricted to that state; the Biltmore ash, from Pennsylvania to Georgia; the white ash, and the red ash are common. Following to the north is the figwort family, represented by *Paulownia*, a native of Central China. Terminating the sequence is the trumpet-creeper family, represented by species of *Catalpa;* among these is the Indian bean, a native of woods in the Gulf States, and Kaempfer's catalpa, from China.

Salicetum

The area occupied by the willow plantation is between the main driveway and the Bronx River, north of the fruticetum, and comprises several acres. Here are brought together moisture-loving willows (*Salix*) and poplars (*Populus*) as a collection apart, many species grown here not being represented in the arboretum and fruticetum. In the corner of the salicetum, next to the driveway, is a group of willows, consisting, in part, of the red-stemmed willow, of horticultural origin, and the slender purple willow. To the east of this may be found the golden or yellow willow, of common occurrence in eastern North America, but a native of Europe and Asia, and the Bashford

willow, a native of France. Along the west bank of the Bronx River may be found the Eugene poplar, of horticultural origin; and a row of the weeping willow, a native of southeastern Europe and Asia. At the northern end of the area devoted to this plantation are to be found, among others, the purple willow, a native of Europe, Northern Africa, and Asia; and the black willow, of eastern North America. Many other species are represented in this collection.

7. The Fruticetum

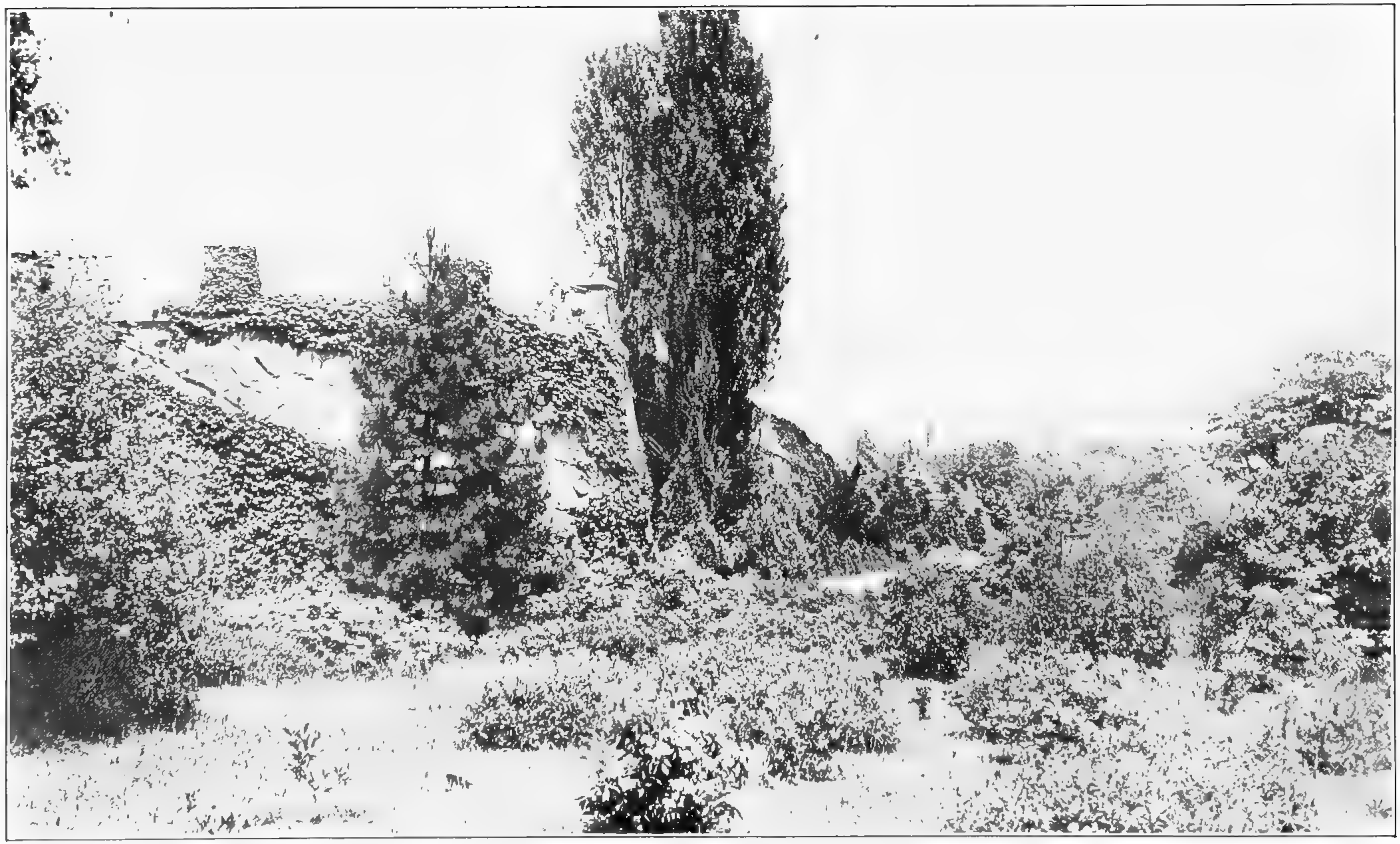
[COLLECTION OF SHRUBS]

This plantation, occupying about 16 acres, is located to the northward of the lakes in the rear of the museum building, and is confined to the area lying between the lakes, the railroad, the woodland on the east, and the north meadows. In this collection are brought together specimens of hardy woody plants which are shrubs, that is, plants with woody stems which branch from the ground and have no single main stem. The arrangement here parallels that in the herbaceous grounds and in the other systematic collections. The sequence begins on the southerly side near the long stone bridge which crosses the Bronx River, and proceeds on both sides of the path running to the north along the edge of the woods, returning southward on both sides of the path paralleling the main north and south driveway, to the peach family, on the bank overlooking the water garden. It then crosses to the senna family directly opposite and overlooking the westerly lake, proceeding northward from there across the transverse driveway, and following the line of the path paralleling to the westward the main north and south driveway. The sequence then continues to the westward along the north path, again extending southward at the Woodlawn Road entrance, continuing on both sides of the westerly path and terminating with the thistle family at the westerly end of the lake near the railroad border. The families will be

referred to below in this sequence. Woody vines are grown at the viticetum.

The pine family, represented among others by low-growing junipers and pines, begins the sequence to the southward of the approach to the long bridge. The next is the willow family, beginning across the road from the pine family; this group is located on both sides of the path and comprises many forms from various parts of the world; the family is largely an inhabitant of temperate regions, so many species can be grown here. The bayberry family occurs across the driveway from the willows, occupying a position on the bank overlooking the water garden. Here may be found the sweet-fern, a native of eastern North America; the sweet gale, at home in north temperate regions; and the waxberry or bayberry, common in north-eastern North America; the berries of the latter have a covering of wax, which is separated by throwing the berries into hot water, when the wax melts and rises to the surface, where it is skimmed off; it is still used to some extent in making candles. The monotypic corkwood family is represented by the corkwood (*Leitneria*) of the southern United States, which has proven to be hardy here at the foot of the terrace, its catkins flowering early in the spring. The birch family follows the willows on the east side of the path; here are the hazel-nuts, the alders and the shrubby birches; the common hazel-nut, of eastern North America, and the beaked hazel-nut, from northern North America, also the common hazel-nut or filbert of Europe, and others; the smooth alder, common along streams and in swamps, in the eastern United States, is also here. Following the birch family on the same side of the path comes the beech family; here may be found the shrubby oaks, and the chinquapin of the southeastern United States. On the same side of the path, a little farther along, is the elm family, represented by the dwarf elms; most of the members of this family are trees and may therefore be found in the aboretum. Immediately following this is the

VIEW IN THE FRUTICETUM, OR SHRUB COLLECTION



WOODLAWN ROAD ENTRANCE, FRUTICETUM

mulberry family, represented here by specimens of the Russian mulberry.

The crowfoot family occupies a space just to the north of the willows west of the path, and is represented by the moutan or tree peony, from China, and the shrub yellow-root (*Xanthorrhiza*), from the southeastern United States; its roots are yellow, and at one time were employed as a dye; there are many herbaceous members of this family at the herbaceous grounds. The barberry family is a little farther north on the same side of the path; many species of barberries and mahonias occur here. Among the barberries may be mentioned: the common barberry, native from Europe to eastern Asia, the ripe fruit of which is sometimes made into preserves, and the unripe ones pickled as a substitute for capers—its bark is used as a dye and for tanning leather; Thunberg's barberry, from Japan, a desirable plant for small hedges and for the borders of walks; the neat barberry, from the Himalayan region, which colors a beautiful red in the fall; and the spine-toothed barberry, from the Himalayan region; the mahonias are represented by the Oregon grape, from northwestern North America; and the Japanese mahonia, distributed from the Himalayan region to China and Japan. The magnolia family occurs a little back from the path, between the crowfoot and barberry families; there are here several species of shrubby magnolias, and others will be found at the deciduous arboretum. The strawberry-shrub family is located on the point dividing the paths, opposite the mulberries already referred to; here may be found several species of the strawberry-shrub, and the oriental sweet-shrub, from China and Japan. A short distance to the north of the strawberry-shrub family is the laurel family, represented by the spice-bush (*Benzoin*), a native of northeastern North America; as the different kinds of flowers, staminate and pistillate, are borne on different plants, only those having pistillate flowers bear the bright red berries in the summer and autumn. In

the lower land below, to the east of the path, is the Virginia willow family, with shrubs of the Virginia willow, a native of the southeastern United States. Across the path from this is the hydrangea family; here may be found the syringas (*Philadelphus*), the deutzias and the hydrangeas, several species of each; the mock orange (*Philadelphus coronarius*), a native of the Caucasus, Armenia, and Europe, indicates its presence by the rich fragrance of its flowers; the slender deutzia, from Japan, bears its long slender clusters of white flowers in great profusion; the lawn hydrangea bears a profusion of large bunches of white flowers, which in the late summer and autumn change to a beautiful rose color; the oak-leaved hydrangea is perhaps the oddest member of this genus and is a native from Georgia and Florida to Mississippi. Following the hydrangea family comes the gooseberry family, and to this belong the currants and gooseberries; one of the showiest is the golden currant, native from South Dakota to Texas, its rich yellow flowers giving forth a delicious spicy fragrance. The witch-hazel family is located to the north of the north path and on the point opposite; here is the witch-hazel, of eastern North America, from which the extract of witch-hazel, or Pond's extract, is made, the Japanese witch-hazel, and also a Chinese representative of this genus; the common corylopsis, a Japanese shrub, belongs here, as do the fothergillas of the southeastern United States.

The rose family occupies a large area, beginning just north of the gooseberries and currants and extending westward to the main north and south driveway, and southward along that as far as the first transverse path; here belong the spiraeas, of which there are many forms, the blackberries, the raspberries, the roses and others. Among the spiraeas, the steeple-bush or hard-hack and the hairy meadow-sweet are common as wild plants in this latitude. Other interesting forms are Thunberg's spiraea, from Japan, one of the earliest to flower, and other Japanese spiraeas. Among other plants of interest in the group

which contains the spiraeas are the Chinese pearl-bush, a native of China, with its profusion of white flowers in early summer; the Japanese rose (*Kerria*), from Japan, not a true rose, however, with bright yellow flowers; another shrub from Japan, the white Japanese rose (*Rhodotypos*), bears large white flowers resembling in appearance those of the mock orange; two other Japanese shrubs, the common and the large-leaved stephanandra, are exceptionally graceful and attractive plants; *Neviusia*, an extremely local plant, known in a wild state only in Alabama; and the nine-barks (*Opulaster*). To the southward of the spiraea group comes the collection of blackberries and raspberries (*Rubus*) represented by many kinds; two of the showiest are the wineberry and the thimble berry (*Rubacer*), the latter common in rocky woods in this part of the country. Farther to the south is the group of the true roses; many kinds may be found here, including the sweet-brier, the dog-rose or wild-brier, and the red-leaved rose, all natives of Europe; the pasture rose of the eastern United States; and the odd-looking Watson's rose, a native of Japan. Numerous herbaceous species of the rose family are grown at the herbaceous grounds.

Following this is the apple family; to this belong the apples and pears, many of which, being trees, may be found in the arboretum. Of a shrubby habit, and therefore members of this collection, are many of the hawthorns or thorn-apples, the quinces, the cotoneasters, the choke-berries, the service-berry and the shad-bush. Southward across the driveway from these, and overlooking the easterly lake, is the collection illustrating the peach family, to which belong the plums, cherries, apricots and peaches. As many of the species of this family are trees they may be found at the arboretum. Among those represented here are the western sand-cherry, of the central United States; the double-flowered plum and the dwarf cherry, from Europe.

Crossing the driveway to the west, the sequence is again taken up on the ground overlooking the west lake, with the

senna family, represented by the Asiatic red-bud, of China and Japan, and the American Judas-tree of the eastern United States; in spring, before the appearance of the leaves, these are profusely covered with pink or purplish flowers. Across the transverse driveway to the north, and directly on the opposite side, may be found the pea family. Here are various species of the pea-tree: the pigmy pea-tree, ranging from the Caucasus to Siberia and Thibet; the Chamlagu pea-tree, from northern China; the Chinese pea-tree; and the small-leaved pea-tree. The Scotch broom and the dense-flowered broom, of Europe, have representatives here; of these, the former, in Spain and France attains the size of a small tree, and its wood is highly prized for veneering and cabinet work; its branches are extensively employed for making brooms, whence its common name. Other plants of interest are the false indigo, the rose acacia, and Kelsey's rose acacia, all from the Southeastern United States; the tall bladder-senna, from southern Europe and northern Africa; and the scorpion senna, from southern Europe. Immediately beyond is the rue family, illustrated by the hop tree (*Ptelea trifoliata*) of the eastern United States; the prickly ash, from the northeastern United States, Bunge's prickly ash, from China, and the Japanese prickly ash from Japan and Korea; the trifoliolate orange, from northern China, which has been used as one of the parents in the recent hybridization experiments by the U. S. Department of Agriculture in its effort to produce a more hardy orange; the lemon and forms of the orange may be found in conservatory range 2, together with other woody members of this family. Following this is the box family, represented by a number of forms of the box-tree, from Europe, Asia and Japan; the wood of the box-tree is highly prized for wood-engraving, on account of its hardness and close fine grain, and it takes a fine polish. A few steps farther on is the sumac family, to which belongs the common poison ivy, so frequent in and around

New York City; here are the fragrant sumac, the mountain sumac, and the smooth, or scarlet, sumac, all from the eastern United States; Osbeck's sumac is a stately shrub from China. The European and the American smoke-trees (*Cotinus*) are relatives of the sumacs; the former is sometimes called the wig-tree, on account of the flower-clusters, which become white and feathery in fruit; a dye is obtained from it which is called young fustic.

Crossing the transverse path to the triangle, the holly family is on the nearest point, shown by Siebold's holly and the Japanese holly, both from Japan, and the American holly; the European holly is grown in conservatory range 2. The Virginia winter-berry, of the eastern United States, bears its bright red berries far into the winter. On the opposite corner of the triangle is the staff-tree family, illustrated by many forms of *Euonymus;* the European spindle tree, the burning-bush of eastern North America, the winged spindle-tree of China and Japan, and Bunge's spindle-tree of the Amur region are shown. Crossing the path to the north of the triangle we come to the maple family; most of the maples are trees, so they must be looked for in the arboretum, but here are specimens of the Ginnala maple, from Manchuria, northern China, and Japan. Immediately beyond this is the bladder-nut family, represented by species of the bladder-nut (*Staphylea*), both from the New and the Old World. Following the path to the west, we come to the buckeye family, represented here by the small-flowered buckeye, from the southeastern United States; many of the buckeyes and horse-chestnuts are trees, and are grown in the arboretum. Following this is the soapberry family, with the genus *Xanthoceras*, a native of northern China, as a representative. At some distance from the path to the left is the buckthorn family; the most familiar plant here is the New Jersey tea or red root, of eastern North America; its leaves were formerly used as a substitute for tea; the jujube, an inhabitant of the Mediterranean region and temperate Asia,

is of this family, its edible fruit oval in shape and about the size of a plum, with an acid taste when fresh; the Dahurian buckthorn, growing wild from central Asia to the Amur region, and the purging buckthorn of Europe and western and northern Asia, the berries of which are medicinal, are here; from the juice of the ripe fresh berries of the purging buckthorn, mixed with alum, is made the pigment, known as sap-green or bladder green, used by water-color artists. Close to this is the linden family, represented by the genus *Grewia*. The mallow family, further along the path, is represented by specimens of the rose-of-Sharon (*Hibiscus syriacus*), from Asia, and often found escaped from cultivation in the eastern United States; many herbaceous representatives of this family may be found at the herbaceous grounds. Near the mallow family is the tea family, represented by the mountain *Stewartia*, from the southeastern United States; other members of the tea family, including the tea plant and the common camellia, may be found in conservatory range 2. Also near the mallows may be found the St. John's-wort shrubs (*Hypericum*), with their showy yellow flowers. Farther on, where the path bends to the left, is the tamarix family, represented by several species of tamarix, Old World plants. Next comes the mezereon family, having as a representative the leather-wood or moose-wood (*Dirca*), of the eastern parts of North America; the name leather-wood refers to the very tough inner bark; the bark is a violent emetic; the daphnes are of this family, and here will be found the garland-flower, the spurge flax, and the Chinese daphne.

Some distance from the path and opposite the Woodlawn Road entrance, is the oleaster family, including several species of oleaster, the buffalo berry, and the sea-buckthorn, a native of Europe and Asia, the berries of which are acrid and poisonous; the berries of several of the species of oleaster are edible; the buffalo berry, of central North America, is largely eaten by the Indians of that region; the berries

of the oriental oleaster, known as Trebizond dates, are made into cakes by the Arabs, after having been dried. Plants of the ginseng family form a group opposite the same entrance, some of these being quite tropical in aspect; the Chinese angelica-tree, from China and Japan, is one of these, and another is Maximowicz's acanthopanax, from Japan; the variegated Chinese angelica-tree is quite ornamental. Beyond this group, and on both sides of the transverse path, is the dogwood family, shown by many species of dogwood or cornel (*Cornus*), from both the Old World and the New; the red-osier dogwood, the kinnikinnik and the panicled dogwood are American representatives; the officinal dogwood comes from Japan and China and is known in Japan as sandzaki; the dogberry, gater-tree, or hound's-tree, is from Europe and the Orient; its wood is hard and is sometimes made into butchers' skewers and tooth-picks; in France, an oil used for burning and in soap-making is extracted from the black berries. *Benthamia japonica*, the Japanese flowering dogwood, from China and Japan, is shown in a number of specimens; this is related to our native flowering dogwood, *Cynoxylon floridum*, which will be found in the deciduous arboretum.

Across the path from the dogwoods, at the foot of the steps, may be found the white-alder family. Here are the Asiatic sweet-pepper bush and the North American sweet-pepper bushes or white-alders, their fragrant white flowers appearing in August. The heath family is next, represented by many forms of azaleas and rhododendrons; the Japanese *Pieris* is a pretty plant, and another, from the southeastern United States, is called mountain fetter-bush; the stagger-bush, of the southeastern United States, is also here. Following the path to the south, we come next to the huckleberries and to the shrubs of the storax family. On the other side of the path is the olive family, which covers a large area, extending along the path for a considerable distance; the olive-tree is the type of this family, and specimens may be found at conservatory range

2; in the fruticetum are several forms of the golden-bell (*Forsythia*), mainly from China; a number of the privets, including the California privet, so much used for hedges; a variety of lilacs (*Syringa*), including the Rouen lilac, hairy Chinese lilac, the Pekin lilac, from northern China, the Himalayan lilac and the common lilac, a native from southeastern Europe to the Caucasus, so frequently cultivated in gardens, and the genus *Forestiera.* To the right of the path and following the storax family is the logania family, with species of *Buddleia*, including the summer lilac, from China. Following this is the vervain family, and some of these shrubs are especially attractive in fruit, among them being the Chinese callicarpa, and the Japanese callicarpa; most attractive is the late-flowering clerodendron, known as kusagi in Japan, where it is native; its flowers have a delicious spicy fargrance, much like that of the sweet-pepper bush; the sepals are a beautiful rose color, while the corolla is creamy white; it blooms late in the summer or early fall, when flowers of shrubs are few.

We next come to the potato family, shown here by the matrimony vine, a native from China to southeastern Europe, but often found growing wild, its purple flowers followed by bright red berries; most of the hardy representatives of this family are herbs, so must be sought for in the herbaceous grounds, while many of the woody species, and some of the herbs, are tender, and may be found in house 2 at conservatory range 1. The figwort family is shown in a single representative from the northwestern United States, *Pentstemon Scouleri;* many other representatives of this family are in the herbaceous grounds and in house 2 at conservatory range 1. The succeeding group is the honeysuckle family, to which is allotted a large area, there being many hardy kinds; the viburnums are represented by many species, both from the Old World and the New, such as the European cranberry-tree, from Europe, Northern Africa, and Western Asia, ornamental by its masses of bright red fruit; the dwarf cranberry-tree, an

exceedingly compact form, very dense in its growth; Thunberg's viburnum, from China and Japan; Siebold's viburnum, from Japan; the Japanese snowball, from China and Japan; the wayfaring tree, from Europe and western Asia; and the woolly viburnum, from China and Japan; among American forms may be mentioned the veiny arrow-wood, the black haw or sloe, the withe-rod, and the larger withe-rod with its large bunches of showy fruit. The group of the honeysuckles occupies a position across the path from the viburnums, and here may be found, among others, the fragrant honeysuckle, from China, one of the first to send forth its blossoms richly laden with perfume; Morrow's honeysuckle, from Japan, covered with coral-red fruit in late summer and fall; Standish's honeysuckle, from China; Albert's honeysuckle, from Turkestan; the Turkestan fly-honeysuckle; and the golden-veined honeysuckle, from China and Japan, with the veins richly marked with yellow, or sometimes the whole leaf yellow. Across the transverse path to the south, and overlooking the lake, may be found the weigelas, symphoricarpos and the diervillas; the weigelas are illustrated by many showy forms, flowering in early summer; the showiest *Symphoricarpos* is the smooth snowberry, native of northern North America, laden in autumn with its ivory-white fruit, making it most attractive; the diervillas are represented by two or three species, including the bush honeysuckle, a native of northeastern North America. The elder-berries (*Sambucus*) are also represented by two or three species. The hybrid abelia will also be found here; its fragrant flowers are borne in great profusion during late summer and early fall; the sepals are deep red-brown and the corolla is white, flushed with rose, making a pleasing combination.

Following the viburnums comes the thistle family. Few of the woody species of this family are hardy in this latitude, but large numbers of the herbaceous species may be found at the herbaceous grounds. As representatives in

the fruticetum, we have the groundsel-bush or pencil-tree (*Baccharis*), a native of the southeastern United States, bearing in the fall a profusion of white fruit, making it a most attractive object.

Viticetum

The area devoted to the plantation of hardy vines is above the easterly side of the economic garden, where a rough arbor has been constructed for them to climb upon. The arrangement begins at the southerly end of the arbor, on the left hand side, with the smilax family, to which belong the green-briers or cat-briers, and the yam family is placed immediately opposite to the right. The birthwort family, with the dutchman's-pipe as a representative, follows the smilax family on the left. On the left hand side, and beyond the birthwort family, is the akebia family, where one may find the five-leaved akebia, a native of Japan. Following this on the same side is the moonseed family, to which belongs the Canada moonseed. On the opposite side of the arbor is the hydrangea family. Following this, also on both sides of the arbor, is the pea family, including species of the peas and wistarias. Further on, occupying both sides, is the staff-tree family, where may be found the climbing bitter-sweet and other vines of this family. Succeeding this comes the grape family, to which belong the grapes, the Virginia creeper and the Japanese ivy. Beyond the grape family, is the actinidia family, represented by the sharp-toothed actinidia. Then comes the trumpet-creeper family, of which the trumpet-creeper, a native of the southeastern United States, is a member. This family in turn is followed by the honeysuckle family, represented here by several species of honeysuckle and woodbine.

8. The Herbaceous Garden

The systematic collection of hardy herbaceous plants is situated in a valley southeast of conservatory range 1, and between the main driveway and the western border of

VIEW IN THE HERBACEOUS GARDEN

the woods fringing the hemlock grove. This valley is about 1,500 feet long and averages about 300 feet wide. A small stream runs through it from north to south and is here and there broadened out into pools. The plants are arranged in beds according to their natural botanical families. At the southern end are the seedless plants, represented by the ferns and their allies; east of the brook are the families of seed-bearing plants belonging to the large endogenous division, or those with parallel-veined leaves and with one seed-leaf (monocotyledons). To the west of the brook are the families belonging to the exogenous division of plants, or those in which the leaves are usually net-veined and which have two seed-leaves (dicotyledons); this latter group embraces the larger part of the plants in the collection. Along the brook, or in it, may be found many aquatic plants, representing in some cases families which are exclusively water-lovers, while in other cases they are aquatic representatives of families occurring in the immediate vicinity in the beds. In this plantation, the family groups are arranged substantially in a sequence beginning with those of simpler organization and proceeding to the most complex.

The series commences in the southern corner of the valley at the foot-path entrance, where the hardy ferns and their allies may be found, including species from many parts of the north temperate zone. Among these may be mentioned the ostrich fern, the cinnamon fern, Clayton's fern, the royal fern, the brake or bracken, and a number of species of the shield-ferns and of the spleenworts. Some of the aquatic representatives of the ferns and their allies may be found in the pond nearby.

In this pond may also be found the following aquatic endogenous families: the cat-tail family, the bur-reed family, the pond-weed family, and the tape-grass family. At the junction of the brook with this pond is the water-plantain family, including, besides the water-plantain, several species of arrow-head (*Sagittaria*). A little be-

yond, in the brook, may be found the water-poppy family, represented by the water-poppy, a showy plant common in tropical regions; this is not hardy and must be removed to a warm place for the winter; it will also be found at all times at conservatory range 1, house 9.

Following to the north comes the large group of the grasses and grass-like plants, those whose flowers, mostly very small, are subtended by chaffy scales or glumes. This is represented by the grasses and the sedges, several beds being devoted to each of these families. Some of the more familiar grasses are: timothy; Kentucky blue-grass; reed canary-grass; orchard grass; red-top; and tall fescue-grass; all used in making hay. Other grasses of interest are: sweet vernal-grass, exhaling a pleasant odor when bruised; the Japanese plume-grass, in several forms, very ornamental; the ribbon-grass, a variegated form of the reed canary-grass, and also ornamental; and species of many other genera.

The sedges are represented mainly by the large genus *Carex*, of which there are many species, native in the United States, growing in swamps, meadows, and woodlands. Fraser's sedge (*Cymophyllus Fraseri*) is a striking plant from the southeastern United States, at one time one of the rarest of plants, but rediscovered in recent years in large quantities in the mountains of North Carolina. The tussock sedge, common in our swamps in early spring, the cat-tail sedge, Gray's sedge and the fox sedge, are others belonging to the genus *Carex*. There are also representatives of bullrushes and other sedges.

Following the sedges is the arum family, having as representative plants, familiar to many, the skunk cabbage, the green arrow-arum, the green dragon, the jack-in-the-pulpit, and the sweet flag. In the brook opposite to this family may be found the somewhat related duckweed family; the duckweeds (*Lemna*) are very common, the tiny plants sometimes occurring in such numbers as to cover the surface of ponds and slowly moving streams. Coming now to the

spiderwort family, we have represented mainly the spiderworts and day-flowers. In a small pool and along its eastern edge is placed the pickerel-weed family. Here may be found a large clump of the pickerel-weed (*Pontederia*) which is common in swamps and along streams in the vicinity of New York; here may also be found the water-hyacinth, which has become such a pest in some of the rivers of Florida and the West Indies, and the closely related blue water-hyacinth, of more straggling habit, also of tropical origin, planted out in summer; neither of these is hardy; they may be found at all times at conservatory range 1, house 9.

The rush family occurs next in the sequence, represented, among others, by such familiar plants as the common bog-rush, the slender rush, and the common wood-rush. Following this come the members of the bunch-flower family, with several species of bellworts, the turkey-beard, the Japanese toad-lily, the fly poison, and others. Closely related to this is the lily family; one of the beds given over to this family is devoted to the true lilies (*Lilium*) in several forms; another is set aside for the onions and their relatives, of which there are many interesting forms, some of them of decorative value; while another bed is given to a miscellaneous collection of plants belonging to this family, among which may be mentioned the day, or plantain, lilies, the yellow day lilies and the lemon lilies, the true asphodel or king's sword, the grape-hyacinth and Adam's needle. Other close relatives of the lilies belong to the lily-of-the-valley family; here may be found many familiar plants, among them being the lily-of-the-valley (*Convallaria*), the wild spikenard, the common asparagus, of such wide use as a vegetable in the early part of the summer, and several species of the Solomon's-seal.

The amaryllis family is shown by a number of species of daffodils and narcissus. In the iris family, which comes next, many species are represented. Most familiar among these are: the common blue flag of our swamps, the yellow

flag of Europe, the fleur-de-lis, the Siberian iris, the Japanese iris and the blackberry lily. For the canna family reference is made to the plantations at the Garden fountain at the approach to the museum building, to the large collection of different kinds at the Horticultural Garden, and to house 11 of conservatory range 1; cannas are not hardy and must be removed to a warm place for the winter. For orchids, the most highly developed of the endogenous plants, reference is made to conservatory range 2, houses 2 and 6B.

Crossing the brook now by the path paralleling the driveway, we come to the beginning of the sequence of the large series of plants with net-veined leaves and with two seed-leaves (dicotyledons). This series begins with the lizard's-tail family, represented here in the brook by the lizard's-tail (*Saururus*), a common plant of our brooks and river borders in the eastern United States. To the nettle family one bed is at present given, located near a group of magnolia trees, where may be found, among other kinds: the slender nettle, of North America; the stinging nettle, native in Europe and Asia, but introduced into this country; and the wood nettle, also a North American plant; all of these secrete an oil through the hairs covering the stem and leaves, this oil being irritating to the skin, especially in the stinging nettle. In the immediate neighborhood and to the right is the birthwort family, represented by several species of wild ginger (*Asarum*), among them the common one of this region, the short-lobed wild ginger, the root of which is of medicinal value. To the buckwheat family there are at present devoted three beds, forming a group to the left of the nettle family. The docks (*Rumex*) are shown in many forms, as are the knotweeds (*Polygonum*) and related genera; the most showy of these are the Japanese and Sakhalin knotweeds; the latter, a plant of considerable economic importance, being used as a fodder plant, is a native of the Sakhalin Island; to this family also belong rhubarb, or pie-plant, and buckwheat. Next to this

and near the brook is the goose-foot family, with several species, one of which, the lamb's-quarters (*Chenopodium*), is native of Europe and Asia, but is found as a common weed in waste places and along roadsides in this country; its young shoots are sometimes used as a vegetable. Closely related to this, and just south of it, is the amaranth family, represented by several species of the pigweed, many of them among the commonest weeds of our roadsides and waste places. Forming a series to the right of this are: the whitlow-wort, four-o'clock, pokeweed, carpetweed and purslane families. In the whitlow-wort family are gnawel, a common weed of fields and waste places, and the forked chickweed. In the four-o'clock family may be found the common four-o'clock of our gardens, a native of tropical America, its flowers opening only on cloudy days or late in the afternoon on clear days, whence its name; and the umbrella-worts, from North America. In this vicinity is the Madeira-vine family, to which belongs the genus *Basella*, here represented. The pokeweed family is present in the common poke or garget (*Phytolacca*), native of the eastern part of North America, a plant of medicinal value and poisonous, but its young shoots when first appearing above the ground are sometimes used as "greens." In the carpetweed family are the carpet-weed, from which the family derives its name, a native of the United States and Mexico, but a common weed in this vicinity; and representatives of the south African fig-marigolds (*Mesembryanthemum*), many of them very showy; they are not hardy in this latitude and must be planted out every spring. In the purslane family, among others, may be found the sunplant or common portulaca of the gardens, a native of South America; the small-flowered talinum, from the central United States; and the common purslane or pusly, a pernicious weed in many sections of the country, and often used for "greens" or as a salad.

Then comes the chickweed family, with sandworts, chick-

weeds and related plants. The pink family follows, where many kinds of pinks, catchflies, and gypsophils may be found. In the first pool, formed by the widening of the brook, is the water-lily family; the large yellow pond lily or spatterdock, a native of eastern North America, may be seen here, as may also its relative, the red-disked pond lily, from northeastern North America; the sweet-scented water-lily, and its variety, the pink, or Cape Cod, water-lily, also find a place here. The tanks in the court of conservatory range I contain a great many additional kinds. The water-shield family, is represented in the pool by the water-shield, a native of North America. The horn-wort family likewise occupies a position in this pool. The aquatic members of the crowfoot family are grown here, the terrestrial forms being placed in four beds to the westward; one of these beds is given up entirely to the peonies (*Paeonia*), of which there are a number of interesting and handsome forms, and others may be seen at the flower beds at conservatory range I; and in the other beds may be found lark-spurs, columbines, buttercups, meadow-rues, anemones, liver-leaf, and many other relatives; aconite, or monk's-hood, of great medicinal value, also belongs to this family.

The barberry family, which is represented by a single bed on the ridge to the right of the crowfoot family, contains, among others, the blue-cohosh and the may-apple or mandrake (*Podophyllum*), natives of North America; the twin-leaf, a native of the northeastern United States; and of Japanese plants, the red epimedium. In the poppy family may be found the oriental poppy, a native of Asia Minor and Persia, and here may be seen also the cordate *Macleaya*, from Japan, and the Mexican poppy, a native of Mexico and found as a weed in many tropical and warm temperate regions. In the fumitory family are the bleeding-hearts (*Bicuculla*), represented by the wild bleeding-heart from the eastern United States. The mustard family, which comes next in the sequence, occupies two beds. To

this family belong the candy-tufts, represented here by the evergreen candy-tuft, from southern Europe and Asia Minor, and the alpine rock-cress, from Europe and North America, one of the showiest flowers in early spring, its mantle of pure white flowers making it a conspicious object; there are many other species represented in this group. The caper family has as representatives the showy pedicellaria, a native of the Old World, and the clammy weed (*Polanisia*), from northern North America. The white and yellow cut-leaved mignonettes (*Reseda*) represent the mignonette family. Across the path to the right, on the ridge and partly surrounding a rocky knoll, is the bed devoted to the orpine or stonecrop family, where there may be found many of the stonecrops (*Sedum*), among the more showy and attractive being: the great purple stonecrop, the great stonecrop, the white stonecrop, and the mossy stonecrop, all natives of Europe and northern Asia; the wild stonecrop from our own country; the Siberian stonecrop and the poplar-leaved stonecrop, both from Siberia; and a Japanese species, Siebold's stonecrop; also belonging to this family are the houseleeks (*Sempervivum*), of which there are many representatives, all from the Old World, however, as these plants are not indigenous to the New World. Many other species of this family, not hardy in this latitude, may be found at conservatory range 1, houses 5 and 6. Across the path from the orpine family may be found the three beds devoted to the saxifrage family. The heart-leaved saxifrage, with its large, thick leaves, from Siberia, is one of the showiest plants here, sending up its large masses of pink flowers early in the spring, so early sometimes that they are nipped by the frost. Among other plants here may be mentioned: the alum-root, from the eastern United States; the two-leaved bishop's-cap, from the northern United States; the Japanese plant, *Rodgersia;* and the shield-leaf saxifrage, from the western United States. Menzies' saxifrage, from western North America, is interesting from the fact that

in late summer and fall it produces small plants at the base of the leaf-blades.

To the herbaceous members of the rose family are allotted five beds, located to the left of the saxifrage family. Many species of cinquefoils and agrimonies may be found here; of the strawberry (*Fragaria*) there are several species represented; the lady's-mantle, from north temperate regions, the various species of avens, the goat's-beard, the burnets and many others, are of decorative value or of interest for other reasons. The roses, blackberries and raspberries, also members of this family, are shrubs, and may be found at the fruticetum. The mimosa family has relatively few representatives in temperate regions, most of its numerous members being confined to warm temperate regions and to the tropics; many of these may be found in house 2 at conservatory range 1, and others, including the attractive acacias from Australia, at the Central Display House, range 2. To the senna family belong the sennas or cassias, a showy representative being the American senna, a native of North America; this family being also largely of warm temperate and tropical distribution, many other species may be found at conservatory range 1, near the mimosa family. To the right of the mimosa family may be found the bed devoted to the pea family; to this some of our most valued economic plants belong, such as the pea, the bean and the clover, which may be found at the economic garden; to the pea family belong also the baptisias, the bush-clovers, the vetches, the tick-trefoils and many other familiar plants.

Next in the order of sequence is the geranium family, to which belong the geraniums or crane's-bills; the plants so often cultivated in the house under the name of geraniums, but which are not hardy out of doors in our climate, are really not what they are called, but are truly pelargoniums, a closely-related group of plants belonging to the same family; our common wild geranium or crane's bill may be found, among other plants here. A little farther on, near

the brook, may be found the bed devoted to the wood-sorrel family, often called sour-grass by children; several species are shown. Just to the left of the geranium family is the flax family, to which belongs the flax plant (*Linum*), from the fiber contained in the stem of which linen is made. Beyond this is the bed for the rue family; to this belong the common rue, of southern Europe, and the fraxinella; this family also includes the oranges and lemons, specimens of which may be found at conservatory range 2, and a very great number of tropical trees and shrubs, located at conservatory range 1, houses 3 and 4. The spurge family is in a bed just to the left of the flax family; the flowering spurge, from the eastern United States, and the cypress spurge, from Europe, but sometimes found wild in this country as an escaped plant, are both here. Along the edge of the brook, and opposite the spurge family, may be seen the water-starwort family, to which belong a number of small aquatic plants. About opposite this, and at the base of the rocky ridge to the right, is a representative of the box family, a Japanese relative, the terminal pachysandra; the true box (*Buxus*) is a shrub or small tree, native of Europe, and several races of it may be found at the fruticetum. A little to the right of the wood-sorrel family is the jewel-weed family, to which belong the common balsam of the gardens, and the plant so common along our brooks and other wet places, and known as jewel-weed, or touch-me-not. A little beyond this are three beds of the mallow family; the hollyhocks belong here, as do the mallows; the crimson-eye mallow and the swamp-rose mallow, both from North America, are showy representatives of this family; and the marsh mallow, a native of Europe and the Orient, is also shown; its root is used in the manufacture of a mucilage and for medicinal purposes.

To the right of the mallows is the bed given over to the St. John's-wort family. The rock-rose family comes next, a little farther on; here belong the rock-roses of Europe and

our own frost-weeds. To the right of this is the violet family; a collection of our native species, together with some from foreign lands, is here brought together and many of these may be recognized as old friends. Near the violet bed is one devoted to the loasa family. Upon the ridge to the right, across the walk, may be found the cactus family; relatively few of these are hardy in this climate, so the larger part of the cactus collection must be sought at conservatory range 1, houses 6, 7, and 8. Here may be found, however, several representatives of the prickly pears (*Opuntia*), including the eastern prickly pear, common in this part of the country, which is frequently found on the rocky ridges in the vicinity of New York and occurs wild on some ledges within the Garden reservation. Down near the brook, and not far from the mallow family, is the loosestrife family, represented by the purple loosestrife, a native of Europe, but introduced in many places in this country; among others belonging to this family is the swamp loosestrife, or willow-herb (*Decodon*), a clump of which may be found along the brook opposite to the loosestrife bed. But a short distance from the violet family is the evening-primrose family; here may be found a number of the evening primroses (*Oenothera*), with their showy yellow flowers, noteworthy as the plants mainly experimented with by Professors DeVries and MacDougal in their studies on the origin of species. Along the brook, not far from the loosestrife family, is the water-milfoil family, represented by the Chilean water-milfoil or parrot's-feather, forming a beautiful mass of feathery green on the surface of the water. Returning now to the ridge, a little beyond the violet family, we find the bed allotted to the ginseng family; here are the Indian-root, from eastern North America, and the heart-leaved aralia from Japan. To this family also belongs the ginseng plant, the root of which is so much prized by the Chinese as a medicine. Down the slope from this group may be found two beds given over to the carrot family, which includes many

economic plants, such as the carrot, parsnip, celery and caraway, all of which may be found at the economic garden; lovage, a common European plant, is shown, and the rattle-snake-master, from the eastern United States; the wild carrot and the golden meadow parsnip also belong here.

To the primrose family, located at the base of the ridge a little beyond the carrot family, belong the primroses (*Primula*), many of which are natives of Europe; here we find the common European primrose, the cowslip and others; the moneywort, a native of Europe, but introduced into many places in this country, sends its long creeping stem all over the bed—this is sometimes known as creeping Charlie; the fringed loosestrife, from North America, is also here, as is the clethra-like loosestrife, from Japan, with its racemes of white flowers. Between the two beds devoted to the carrot family, and a little beyond, is the plumbago family, to which belongs the common thrift of Europe; there are several other thrifts here also, as well as the statices or sea-lavenders, in several species. The bed allotted to the gentian family may be found a little beyond the plumbago family; among them is the blind gentian, a native of the United States. In the brook, just beyond the little stone bridge, may be found the buck-bean family; here are shown the water-snowflake, common in tropical regions, and the water-lily floating heart, native in Europe and northern Asia.

Just beyond the left-hand bed devoted to the carrot family is the dogbane family; the willow-leaved amsonia, from the central and southeastern United States, and the broad-leaved amsonia, from the central and eastern United States, are conspicuous objects here. Beyond this are two beds of the milkweed family and among its representatives are the common milkweed of our roadsides, the hairy milkweed and the swamp milkweed; the swallowworts also belong here and are illustrated by several species. In the morning-glory family, located to the right of the above, are the small bind-weed, of northern Europe and Asia,

sometimes a troublesome weed in this country, and the morning-glory. Following the milkweeds is the phlox family; interesting plants here are the Jacob's-ladder (*Polemonium*), of Europe, with its masses of blue flowers; the hairy phlox, of North America; Britton's phlox, a relative of the common ground phlox, from the southeastern United States; the ground phlox and its white-flowered form, both natives of the eastern United States; and forms of the garden phlox, from the southeastern United States. In the shade, the natural habitat of many of these plants, is the water-leaf family, at the base of a large rock on the ridge; there are the purple, the broad-leaved, and the Virginia water-leaf (*Hydrophyllum*).

Farther along and at the base of the ridge is the borage family; the tuberous comfrey, the rough comfrey and the common comfrey, all natives of Europe, are represented. In the vervain family, in a small bed to the left, may be found the vervains. We now come in the sequence to the mint family, to which are devoted six beds; among the true mints may be found here the creeping whorled mint, the curled mint and the spearmint, all from the Old World. Many familiar plants may be seen in these beds, and among them are: the false dragon-head, of the United States; motherwort, common in Europe and widely distributed as a weed in this country along roadsides and in waste places; the horse-balm, of North America, common in the east in woods; Oswego tea, and other bergamots, natives of North America; the betony and hyssop, of Europe; the hedge-nettles, from both the Old World and the New; the common sage of the Mediterranean region, highly prized by the housewife, and other sages; catnip, a native of Europe, but widely distributed as a weed in this country; Gill-over-the-ground, or ground ivy, also a European plant, but extensively spread as a weed in this country; and the dittany, of North America.

The potato family may be found a little to the left and just beyond the phlox family. Here may be seen the

common jimson, or Jamestown, weed, the seeds of which are poisonous, a native of tropical regions, but a common weed along our roadsides; the nightshade, a European plant, but commonly distributed as an introduction in many parts of this country, also with poisonous fruit; tobacco plants and solanums; it is to this family that the potato, tomato and egg-plant belong, plants of which will be found at the economic garden. A little beyond and to the left of the mints are the two beds allotted to the figwort family; of interest here are: the beard-tongues, of which there are several species; the speedwells (*Veronica*), among them the long-leaved speedwell and the gentian speedwell; the fox-gloves (*Digitalis*), from one of which, the purple fox-glove, the valuable medicine digitalin is derived; Lyon's snake-head from the southern states; culver's-root, from the southeastern United States; and several figworts. Just beyond this may be found the unicorn-plant family, represented by the unicorn-plant. A little beyond is the globularia family, with a single species of globularia. To the right is the acanthus family; not many of these plants are hardy in this latitude, but in house 2 at conservatory range 1 many representatives may be found, as the family is largely confined to tropical and warm temperate areas; in this bed may be seen the hairy ruellia, from the southeastern United States. In this neighborhood may also be seen the lopseed family, represented by the lopseed, a native of eastern North America.

To the right of the acanthus family is the single bed devoted to the plantain family; several species, such as Rugel's plantain and rib-grass, are pernicious weeds in this neighborhood, often disfiguring an otherwise even lawn. Just beyond the mints may be found the two beds of the madder family; to this belongs the dainty little bluets or innocence, which sometimes give a blue sheen to sterile, sandy places, so abundant is it in some localities; it is quite common in eastern North America; several species of bedstraw (*Galium*) may also be found here, while many

other plants belonging to this family are grown at the conservatories, among them the coffee tree. A little beyond is the single bed of the honeysuckle family, represented by the feverworts; this family being largely composed of woody plants, many other species, including the true honeysuckles, may be found in the fruticetum and in the viticetum. To the left is the valerian family with a single bed; here may be found the valerian, a common European plant.

Just beyond the plantain family is the teasel family. It is to this that the teasel plant belongs, used in olden times for raising the nap on woolen cloth. Several species of cephalaria may be found here. Next in sequence is the gourd family, to which belong such common fruits as the cucumber, muskmelon, watermelon and pumpkin, specimens of which will be found at the economic garden. The bell-flower family is a little farther on and to the left of the teasel family; the Carpathian and Host's bell-flowers, both natives of Europe, are pretty representatives here; the creeping bell-flower, or Canterbury bells, also a native of Europe, may be found here in several forms; the Japanese bell-flower and its white variety are also here, their large showy flowers making them quite conspicuous. A little further on and to the left is the lobelia family; the cardinal flower and the great lobelia, both natives of North America, make showy objects; the former is particularly striking in its rich masses of cardinal-red flowers.

To the right of the teasel family is the chicory family. The common lettuce (*Lactuca*), so much used in salads, belongs here and specimens of this will be found at the economic garden; many of the plants are extremely weedy by nature, and this is particularly true of the hawkweeds, a genus richly represented in the Old World, several species of which are shown here; the oyster plant is also a member of this family.

To the left of this may be found the ragweed family. All the species here are of a weedy nature. The ragweed,

the giant ragweed and the common clot-blur find representation here. Terminating the sequence comes the very large thistle family, represented by many species from all parts of the world; there are nine beds at present given over to these plants; the sunflowers, coneflowers, thistles, asters, fleabanes, yarrows, golden-rods, tansies, sneezeweeds, burdocks, artemisias and wormwoods, cat's-foot, tick-seeds, elecampane, boneset, chrysanthemums, colt's-foot and many others are shown; the Jerusalem artichoke, one of the sun-flowers, a native of eastern North America, bears edible tubers.

9. Morphological Garden

This is located to the north of the herbaceous garden, the two collections being separated by the driveway which crosses the valley. It is designed to illustrate here with typical examples the organs and other features of plants, including leaf-forms and the various modifications of their margins, their venation and insertion on the stem; also the various kinds of stems, methods of propagation, flower-clusters and fruits, leaf-movements, parasites, desert plants and seed-dispersal. Looking north on this collection, the first bed to the right of the brook contains plants illustrating simple leaf-forms. Immediately following this on the same side of the brook are the plants representing the various forms of compound leaves, or those in which there is a distinct jointing of the leaflets to the leaf-axis. Farther along the brook, in the pool, may be found various forms of aquatic roots, stems and leaves; and a little beyond this to the right is the bed containing plants illustrating forms of propagation.

The remaining plats of this collection are located on the left hand or westerly side of the brook. The first of these to the right is devoted to leaf-venation, and the one to the left to leaf-margins, the former illustrating the character of the veins and nerves, and the latter the toothing or lobing of the margins. Beyond this to the right is the group of plants showing the manner of insertion of the

leaves on the stem; and to the left of this are specimens illustrating the various ways in which plants may form a mosaic covering on the ground. A little beyond are the examples of stem-forms; one bed shows the smaller kinds, while for the larger examples, illustrating tree-twining, root-climbing and tendril-climbing stems, specimens have been placed to the left of this.

A little beyond the pool may be found the bed illustrating flower-clusters, and still farther on that devoted to parasitic plants, or those deriving their nourishment from the living tissues of other plants. To the left of this and farther up the hill is the group of plants showing leaf-positions. Beyond and a little to the right are plants which are at home in desert regions, and the various means of accommodating themselves to their natural surroundings are shown. Farther on to the right is the bed devoted to fruit-forms; and to the left of this, one showing various forms of seed-dispersal, those with the surface of the fruits covered with some sticky substance or curved appendages or hooked hairs or spines requiring the intervention of some animal for their distribution, while those with wings or with hairs attached to the seed are spread through the agency of the wind. To the right of the above are plants representing a species and a variety, and to the left of this is a bed containing plants showing species and hybrids.

10. Economic Garden

The collections illustrating food plants and those producing substances directly useful to man in the arts, sciences and industries are planted at the northern end of the long glade containing the herbaceous collections just described. The collection is arranged in two series divided by a central grass walk. The beds on each side are numbered consecutively, the number being indicated on a wooden stake in the center. A general sign is placed in each of the beds, denoting what its contents are intended to represent, and in front of each plant is a smaller label giving individual information.

On the east side of a broad central grass path and the brook are located plants used for medicine, those employed as condiments or relishes, and a number of plants from which the fiber is used in the manufacture of various fabrics. The medicinal plants which grow in wet or moist situations may be found on the easterly side of the brook. Along the woodland border is also a collection of medicinal shrubs and trees.

On the west side of the grass path and brook are the food plants. Here may be found many of the common fruits and vegetables. Along the gravel path is a collection of shrubs and trees, containing some of the more common plants producing edible nuts and fruits.

In the eastern series, bed no. 1, located at the northern end, contains plants used as condiments and relishes; here, among others, are peppermint, spearmint, mustard, lovage, lavender, savory, caraway, dill, coriander, basil, marjoram, anise, balm, sage, tarragon, and horse-radish. Beds 2, 3, 4, 6, and 7 contain drug plants. In beds 2, 4, and 6 it is the roots and rootstocks which are employed; such drugs as valerian, Indian physic, convallaria, sanguinaria, podophyllum or mandrake, inula, belladonna, pleurisy-root, rhubarb, cimicifuga, arum, tussilago or coltsfoot, and caulophyllum are here. In bed 3 among the commonly known drugs are catnip, tansy, horehound, and stramonium, the leaves of which furnish the active principles. In bed 7 are plants from the herbage, seeds or flowers of which drugs are manufactured; hops, tussilago or coltsfoot, rue, tobacco, castor-oil, digitalis and dulcamara are some of these. Bed 5 contains plants from which fibers are obtained, such as cotton, flax, used in the manufacture of linen, hemp, and broom-corn, from the inflorescences of which brooms are made. In the adjoining woodland border of shrubs and trees are the prickly ash, barberry, witch hazel, cramp-bark, rhamnus, frangula, euonymus, red-root, shrub yellow-root, and hydrangea. Along the east side of the brook will be found calamus and magnolia.

In the western series, devoted to food plants, in bed no. 1, located at the north end of the first line of beds, are plants the bulbs of which are useful for food; among these are onions, garlic, chives, and leeks. In the adjoining bed 10, the first of the second line, are those furnishing tubers for food, such as the sweet-potato, Irish potato, and Jerusalem artichoke. In bed 18, the first in the third line, are plants with fleshy roots, such as celeriac, oyster-plant, radishes, turnips, carrots, and beets. In beds 2 and 3 it is the leaves which are edible; familiar examples are cabbage, kale, lettuce, Brussel's-sprouts, collards, chicory, Chinese mustard, fetticus, endives, and spinach. In bed 4 are plants, the herbage of which is used; examples here are French spinach or orach, and rocket salad or roquette. It is the stems and leaf-stalks of the plants in bed 11 which are edible; here are asparagus, rhubarb, sea kale, kohlrabi, cardoon, and celery. In bed 5 are cauliflower and broccoli, the flowers being the edible portions.

Many plants furnish food in the shape of fruits. A fruit is developed from the flower, thus differing from a vegetable, which is the edible portion of some part of a plant other than the fruit. Beds 6 to 8, 12 to 16, and 19 to 27 contain plants which furnish edible fruits. These divide themselves generally into two kinds, those in which the fruit is more or less fleshy, such as berries, pumpkins and beans, and those in which the seeds only furnish the food value, such as wheat, barley and other grains. In bed 6 are the egg-plant and okra. In bed 8 will be found peas, beans, and fennugreek; in bed 12 the various kinds of tomatoes; in bed 13 the different sorts of peppers; in bed 14 strawberries; beds 19 to 26 contain each a single kind, as follows: crookneck squash, pumpkin, muskmelon, citron, watermelon, Hubbard squash, English marrow, and cucumber.

In the group containing the grains are the four common cereals, wheat, rye, oats and barley, all in bed 7. In bed 15 are the different kinds of sweet corn. In bed 16 are the field corns, both flint and dent, and popcorn. In bed 27 are buckwheat, sorghum, and rape, among others.

Beds 9 and 17 contain fodder plants. Bed 9 has fodder plants other than grasses, such as alfalfa, red, white and crimson clovers, winter vetch, summer vetch, yellow lupine, blue lupine, and Florida beggarweed. In bed 17 are fodder plants of the grass family, such as teosinte, Johnson grass, field corn, timothy, Kentucky blue-grass, red-top, and pearl millet. In bed 28 is the sugar-cane plant, from the juice of which sugar, one of the most important articles of food, is made; this is a native of the tropics, and it is therefore not hardy in our climate—plants of it may be seen at all seasons at conservatory range 1, house 9.

In the border of woody plants along the gravel walk are such familiar fruits as the hazel-nut, black, red and white currents, gooseberry, blackberry, black-cap, elderberry, chinquapin, barberry, huckleberry, and highbush blueberry. Along the west side of the brook will be found rice, not hardy here, which furnishes the principle article of food for millions of people, especially in the tropics of the Old World; the cranberry plant; taro, also not hardy, an important article of food in the tropics, largely taking the place there of the potato in temperate climates; and water-cress.

11. Decorative Woody Plants

Many collections of this nature will be found in various parts of the grounds. They consist of trees and shrubs, both deciduous and evergreen.

Along the driveways and paths will be found many kinds of deciduous trees, and in the arboretum many other kinds may be studied.

Groups of deciduous shrubs will also be found in many places along the roads and paths, and in the fruticetum, where these are arranged in families, the decorative groups are in close proximity to the families to which they belong. In the fruticetum will also be found a number of evergreen shrubs. Other places where the decorative value of shrubs may be studied are: along the west border, from the Woodlawn Bridge south to the approach to the elevated

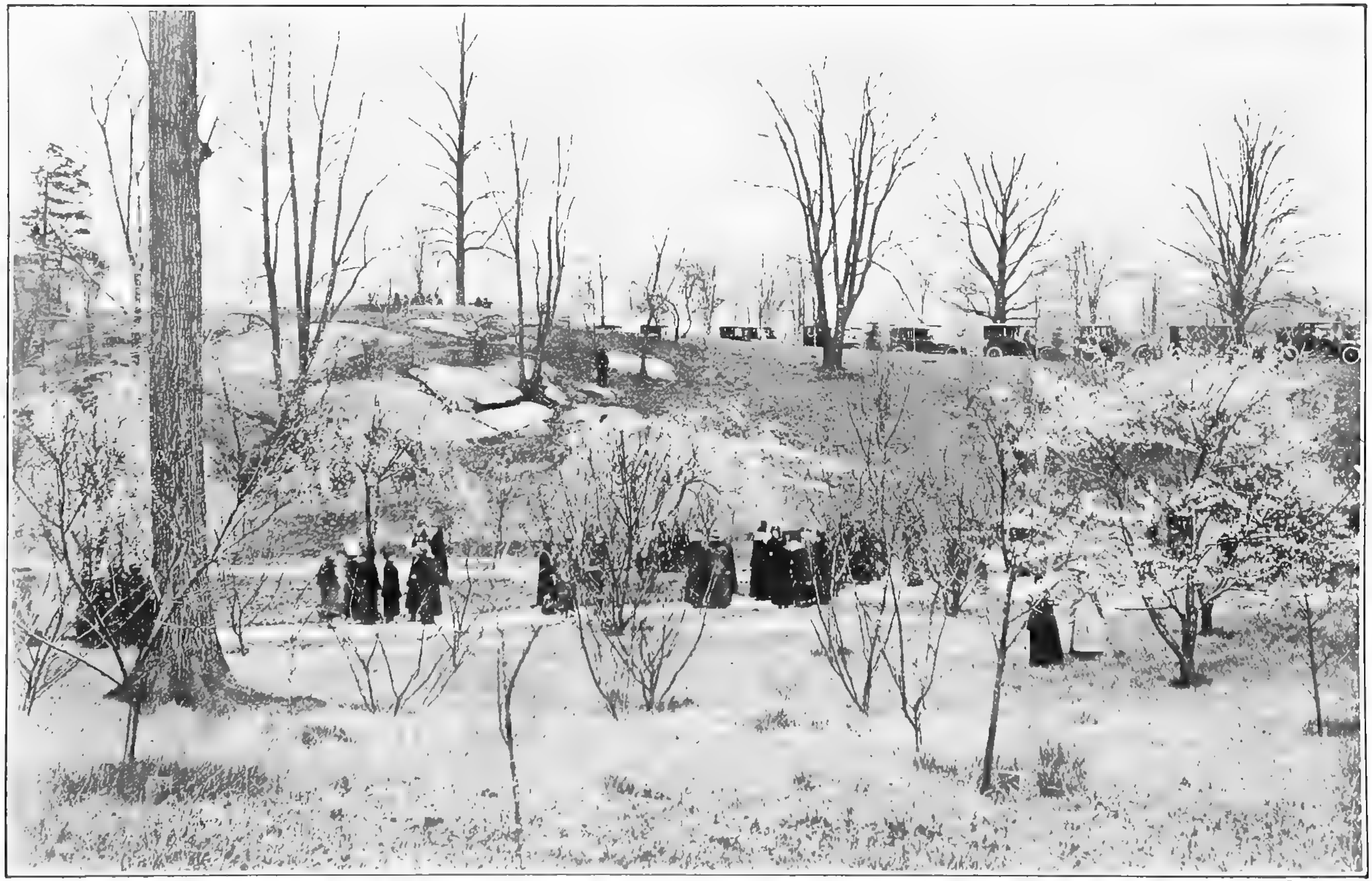
railroad, and at the foot of and paralleling this approach; along the south border; and in the beds in the vicinity of conservatory range 1. Evergreen shrubs, or small trees which may be used in the same manner as shrubs, are divided into two groups, those with broad leaves, such as the rhododendron, known as broad-leaved evergreens, and those with narrow leaves, sometimes like needles, such as pines, hemlocks, spruces, firs, and yews, known under the general term of coniferous evergreens. The rhododendron is one of the most popular of the broad-leaved evergreens. Collections of rhododendrons may be seen on the east and south banks of the upper lake, just behind the museum building; at the west end of the Boulder Bridge; in front of the fountain at the museum building; and on the north side of conservatory range 1. One of the best broad-leaved evergreens for this latitude, and hardy except during a winter of extreme severity, is the Japanese holly, *Ilex crenata*, fine examples of which may be found in some of the beds in the vicinity of conservatory range 1 and at the Mansion.

Coniferous evergreens, as individual specimens, may best be studied in the pinetum. Groups of these plants, used in a decorative way, may be found at the foot of the Woodlawn Bridge approach; at the fountain in front of the museum building; at the foot of the museum approach; at the west end of the Long Bridge; in the beds at the foot of the terrace at conservatory range 1; and in the other beds to the north of the same range. As examples of the mixed planting of deciduous shrubs and of various evergreens, beds nos. 1 to 7 at conservatory range 1 may be cited as an example.

12. The Japanese Cherry Collection

This collection, a part of the deciduous arboretum, is located to the westward of conservatory range 2, in a little sheltered valley which opens out on the main road and the Bronx River. There are about 100 trees in the

RHODODENDRON BANKS AND LAKE BRIDGE



VIEW IN THE JAPANESE CHERRY GARDEN

group. It is to the great patience and care of the Japanese that we are indebted for the great variety in color and form of this truly charming flower. The first to bloom are the rosebud cherry (*Prunus subhirtella*) and the weeping cherry (the variety *pendula*), their rosy blossoms appearing at about the same time, near the middle of April. Following these some two or three weeks come the varieties of *Prunus serrulata*, the earlier ones blossoming usually about the first week in May, the flowering period being continued through the later varieties for two or three weeks. The flowers are single in the variety known to the Japanese as Yoshina, in others they are somewhat double, and quite double in the variety *classica*, to the Japanese known as Fugenzo, and elsewhere often as Jas. H. Veitch, under which name it is usually offered in nursery catalogues. The flowers of this variety are of a deep rose and the foliage a bronzy hue, while in others the flowers are paler, and in some varieties even white; the foliage varies from bronze to bright green. This cherry bears little if any fruit, the great effort of the plant being turned toward the creation of blossoms, of which there is a great abundance. Individual trees, at the height of their season, are literally covered with a mantle of charming flowers. It is no wonder that the Japanese hold this flower in such great esteem.

13. The Rose Garden

This is situated in a little valley east of the Bronx River, and a short distance south of the Mansion. It is of irregular shape, containing about an acre and a quarter, and is about 350 feet long and 200 feet wide at its broadest part. The beds outside of the intramarginal path are planted mainly to such roses as have a short flowering period, commonly known as June roses. Here will be found the hybrid perpetual, the hybrid sweetbrier, the Ramanas, the Bourbon, the moss, the China, and the cabbage roses. Inside of the path above mentioned, are many beds containing hybrid tea, Pernetiana, and dwarf

polyantha roses; these types bloom practically the season through, beginning late in May or early in June and in some varieties blossoming until killing frosts arrive.

None of the plants in the beds outside of the intramarginal path require protection in winter; to prevent whipping in the wind and consequent loosening of the plants in the soil, the long stems are cut back to about three feet late in the fall. The roses in the other beds, however, are protected by hilling up the earth for a distance of six or eight inches around each plant, much as is done with potatoes. This protects the wood from too violent freezing and drying, insuring enough good live wood the following spring to provide the bloom for the coming summer. Each plant is furnished with a label giving the type of rose, the name of the variety, and the name of the donor.

The flight of stone steps which forms the western approach to the garden was the gift of the late Mrs. Robert E. Westcott.

14. Lilac Garden

This collection, located a little to the south of the rose garden and paralleling Pelham Parkway, is being developed. The lilacs are planted in groups around the margin, it being tentatively planned to establish a collection of peonies in the central portion of this area.

15. Flower Gardens

Collections of herbaceous plants useful for horticulture will be found in the border at the Elevated Railway approach; along the path leading from this approach to conservatory range 1 and in the beds in the vicinity of this range; and elsewhere. Something of decorative value is always to be found in these collections, from the appearance of the early bulb-plants, and other harbingers of spring to the arrival of the chrysanthemums in the fall. The plants are plainly labeled, so that the collections may be intelligently studied. If one is interested in establishing a home garden, notes may be made here of such plants as

appeal to the individual, and any color scheme for any period may be thus arranged for. It is not the purpose in these collections to develop any special color scheme, but to bring to the attention of the public as many different kinds as possible of herbaceous plants which may be used in the developing of individual ideas. Many other kinds of herbaceous plants which may be used for decorative purposes may be seen at the herbaceous garden.

The flower beds at conservatory range 1 are on the north side in two series numbered from west to east. One series contains seven beds, and the other, at the base of the terrace on which the conservatory stands, paralleling it on three sides, contains four beds. In these beds and in those on both sides of the path from the Elevated Railway approach to the conservatories are grown many kinds of bulbs, such as snowdrops, glory-of-the-snow, squills, spring crocuses, early tulips, cottage tulips, Darwin tulips, daffodils, poet's narcissus, snowflakes, lilies and fall crocuses. All bulbs have a resting period, their foliage disappearing at this time, leaving bare spots in the flower garden. To avoid this, annuals, or greenhouse plants raised from cuttings, are provided. These are sown or planted in time to follow the bulbs, thus giving a succession of flowers for the summer and fall. In addition to the bulbs there are many other kinds of herbaceous perennials here.

Bed no. 11, located at the foot of the east terrace, is devoted to roses. This collection was established in the spring of 1913. The bed is about 250 feet long and 8 feet wide. There are over 400 bushes, representing about 140 kinds, including hybrid perpetuals, hybrid teas, teas, baby ramblers, moss-roses and others. The two rear rows contain hybrid perpetuals, and a few other kinds, the two front rows comprising hybrid teas and teas.

16. Horticultural Collections

The horticultural collections are situated in the southern part of the grounds, and face the Southern Boulevard.

This area comprises about 5 acres, and is well diversified as to character of soil and conditions, offering level, hilly, rocky, dry, wet, sunny, and shaded areas, making it possible to grow a great variety of plants. It is designed to assemble here collections of plants suitable or desirable for horticultural purposes. A feature is made of the labeling, as in all other collections of the Garden, each plant being supplied with an information label; and, when necessary, a larger label for the bed or collection is employed, indicating its contents.

A large collection of different varieties of cannas occupies the beds paralleling the entrance walk from the Southern Boulevard and the large oval bed at the termination of this walk. The horticultural varieties of cannas are the result of hybridization and selection, and many varieties have been thus produced, new ones being introduced constantly. The species used in this work of hybridization are natives of tropical or warm temperate countries, and are of course not hardy here. The hybrids in consequence are not hardy, and it is necessary to remove the plants for the winter to a cellar or other storehouse where the temperature does not go to freezing, neither should it be too warm, for then the plants will start growth. Preliminary to removal, the stems should be cut a few inches above the ground, the plants being allowed to remain in their summer position until pretty well blackened by the frost. In the early spring the clumps can be broken up and the severed parts planted in flats or in pots, where they are allowed to remain until all danger of frost is past, when they may be planted in their permanent position for the summer.

Back of the north bed of cannas is a group of the white fir (*Abies concolor*), a native of our western country. Between this plantation of firs and the walk is a bed devoted to a collection of plants with variegated or colored foliage, making an interesting and instructive exhibit. Across the walk is a collection of chrysanthemums. To the

east and across the walk from this is a collection of the garden phlox, of which there are many kinds offered for sale and new ones constantly appearing. These are entirely hardy, and may remain out-of-doors continuously.

Along the south walk, on both sides, are beds containing a large collection of gladioli, representing numerous examples of the various types of this popular flower and many horticultural varieties. To the south of this is the Victory Grove, planted with Douglas spruce (*Pseudotsuga mucronata*).

In the low land on the east side is a large collection of mallows made up largely of hybrids produced here at the Garden during a series of experiments. Many of these are desirable for the garden, as the mallows, while naturally natives of moist or wet situations, will thrive under ordinary garden conditions.

Many other collections are planned for this area, including an iris garden, and will be developed from time to time as opportunity offers.

17. Dahlia Collection

This is located in that part of the west border extending from the Harlem Station plaza north to the Mosholu Parkway bridge, a distance of over 400 feet. One of the finest collections is exhibited here each summer, the blooms beginning to appear about the end of July and continuing in an unbroken succession until the time of killing frosts. The various types of the cultivated dahlias are exhibited in many examples, each plant being plainly labeled with the name of the type, the name of the variety, and the name of the donor. This is one of the most popular collections in the Garden.

The dahlia is a native of the highlands of Mexico, very few kinds being known in the wild state. The great diversity of form and color exhibited by the cultivated dahlia has been produced artificially by hybridization and selection. Not a hardy plant, it is necessary to remove the

tubers each fall, after growth has been stopped by the frosts, to a cellar or other storehouse where the temperature does not reach the freezing point, neither should it go much above 45 or 50 degrees.

18. Iris Collection

The iris collection at the southwest corner of the grounds was established in the spring of 1916. In front of a background of conifers and deciduous shrubs is a border 10 feet wide, in which the irises are planted. The iris may be had in flower, by proper selection of kinds, from early spring to the early part of July. The first to bloom are some of the dwarf forms, such as *Iris pumila* and *I. cristata.* Then come those of the rhizomatous type, with creeping rootstocks, such as *Iris germanica, I. pallida, I. sambucina,* and many others. These are followed by the Siberian irises, and these in turn by the Japanese irises, of which there are many beautiful color forms.

19. Water Garden

The water garden is situated northeast of the museum building between the lake bridge and the Bronx River. An attractive display of hardy water-lilies, many of them Marliac hybrids, may be seen here from June until autumn; while the borders of the lake are planted with a variety of water-loving herbaceous plants and shrubs.

20. The Hemlock Forest

The forest of Canadian hemlock spruce along the Bronx River, within the portion of Bronx Park set apart for the New York Botanical Garden, is one of the most noteworthy natural features of the Borough of The Bronx, and has been characterized by a distinguished citizen as "the most precious natural possession of the city of New York."

This forest exists in the northern part of Bronx Park on the banks of the river and their contiguous hills; its greater area is on the western side of the stream, but it occupies a

WATERFALL IN THE HEMLOCK FOREST

BRONX RIVER ABOVE THE LINNAEAN BRIDGE

considerable space on the eastern side above the mansion and below the boulder bridge. The area west of the river extends from just above this bridge down stream to a point nearly opposite the old Lorillard snuff-mill, and is the part commonly designated "Hemlock Grove." Its total length along the river is approximately 3,000 feet; its greatest width, 900 feet, is at a point on the river about 700 feet above the waterfall at the mansion. The total area occupied by the trees on both sides of the river is between thirty-five and forty acres.

While this area is mostly covered by the hemlock spruce, and although they form its predominant vegetation, other trees are by no means lacking; beech, ash, sweet birch, red maple, hickories, oaks, dogwood, tulip-tree and other trees occur, and their foliage protects the hemlocks from the sun in summer to a very considerable extent; there are no coniferous trees other than the hemlock, however, within the forest proper. The shade is too dense for the existence of much low vegetation, and this is also unable to grow at all vigorously in the soil formed largely of the decaying resinous hemlock leaves; it is only in open places left by the occasional uprooting of a tree or trees by gales that we see any considerable number of shrubs or herbaceous plants, their seeds brought into the forest by wind or by birds. In fact, the floor of the forest is characteristically devoid of vegetation, a feature shown by other forests of hemlock situated further north. The contrast in passing from the hemlock woods to the contiguous hardwood area which borders them to the west and north, toward the museum building and the herbaceous grounds, is at once apparent, for here we see a luxuriant growth of shrubs and of herbs, including many of our most interesting wild flowers.

21. The Gorge of the Bronx River

The gorge of the Bronx River extends from the boulder bridge at the north end of the hemlock forest southward for about a mile, nearly to Pelham Avenue, and is a most

beautiful and picturesque natural feature, besides being of great geological significance. Its depth from the summits of the hills on both sides averages nearly 75 feet, and its sides below the foot-bridge at the mansion are nearly vertical rock faces. The hills on both sides are heavily wooded with hemlock spruce and other trees. In the upper part of the gorge the river flows slowly, being held back by the dam forming the waterfall at the mansion, and the elevation of its surface is only a few inches higher at the boulder bridge than it is at the fall; after plunging over the dam, however, the river runs in its unobstructed natural channel with all the appearance of a mountain stream, which at high water is exceedingly beautiful.

22. North Meadows and River Woods

The Bronx River enters the northern end of the Garden from Williamsbridge and flows as a slow stream southward to the waterfall at the mansion, its surface being nearly level throughout this distance. It is spanned just inside the northern boundary of the Garden by a concrete-steel arched bridge with granite copings, which carries the main park driveway across it near the Bronx River Parkway entrance. The entire northern end of the Garden is formed of the flood plain of the Bronx River, consisting largely of grassy meadows and marshes which at average flow of the stream are several feet above its surface, but which at flood time are occasionally submerged for short periods, the whole valley being a very interesting illustration of the behavior of a small stream with a large watershed at and about its sources. Considerable areas of the marshy land have already been reclaimed by filling, and by the lowering of the dam forming the waterfall at the mansion; the general plan contemplates a much further reduction in the amount of marshy ground, and a further lowering and deepening of the river by dredging, in order to take off freshets with greater rapidity. A part of this flood-plain is occupied by the plantations of willows and poplars already described,

and these will be considerably extended, but large areas of meadow will be left in their natural condition.

South of these open meadows, the valley of the river is much narrower and is occupied by several acres of characteristic river woods, containing a considerable variety of native trees and shrubs, extending south as far as the long driveway bridge near the northern end of the hemlock forest.

23. Deciduous Woodlands

The natural deciduous woodlands of the reservation are, collectively, over 40 acres in area, mostly in the central and southern portions of the tract, where they occupy rocky ridges and some of the valleys between these ridges. Along the Bronx River, from the boulder bridge north to the north meadows, are several acres of river woods, subject to overflow at freshet periods. The woodlands contain many species of native trees and a much greater number of kinds of native shrubs and herbaceous plants; the undergrowth is, locally, very dense. They are typical illustrations of forests of our part of the country, and are treated and protected as such. Dead and decrepit trees are removed and dead branches pruned off from time to time; where necessary, young trees are planted to replace those cut out; the woods are patrolled to guard against forest fires. All available firewood obtained is burned in the heating plants of the smaller buildings, and the use of coal is thus reduced. In order to keep these woodland tracts as typical illustrations of eastern United States forests, no extraneous plants have been brought into them, except in one small area on a bank just east of the fruticetum, where many herbaceous woodland species not native of the region have been planted.

Park Features

The whole plan of the development of the Garden has been designed in such a manner as to include all the features of a public park, and it has been carried out in close cooperation with successive park commissioners and engineers of

the Borough of the Bronx. The grounds are open to the public every day in the year without any charge whatever.

24. Entrances

The Garden has entrances at ten points, as follows:

1. Mosholu Parkway. 2. Bedford Park Avenue. 3. Southern Boulevard. 4. Iris Garden. 5. Linnaean Bridge. 6. Mansion Approach. 7. Arboretum entrance (not yet completed). 8. Allerton Avenue. 9. Bronx River Parkway. 10. Woodlawn Road.

25. Roads and Paths

An elaborate series of driveways provides several miles of Telford-Macadam roads, most of which are now constructed.

Paths located so as to lead to all the principal features are included in the plan, with an aggregate length of over fifteen miles and approximately three-fourths of this system has already been built, and there are several miles of forest trails.

All the roads and paths have been located so as to do no damage to the natural features of the grounds, particular care having been taken to save all possible standing trees and to avoid disturbing natural slopes except in the immediate neighborhood of the large buildings, where considerable grading has been necessary, but even here the study has been to adjust the new surfaces so that they shall merge imperceptibly into the original ones. Ornamental masonry retaining walls, made necessary by the grades of the roadways, have been built at the Mosholu Parkway entrance, at the Woodlawn Road entrance, and at the approach to the Elevated Railway Station, and vines have been planted at the bases of these walls which partly clothe them with foliage. The Bronx Boulevard, bounding the Garden to the east, is supported along part of its length by a high rubble-stone retaining wall.

NORTH BRIDGE

BOULDER BRIDGE

26. Bridges

The plan of the driveway and path systems called for the construction of six bridges; three of these, first, the lake bridge, crossing the valley of the lakes near the museum building; second, the long bridge, which carries the driveway across the valley of the Bronx River north of the hemlock forest; and, third, the upper bridge which crosses the Bronx River at the northern end of the Garden, have been carried out in masonry arches from designs by Mr. John R. Brinley, landscape engineer of the Garden. A unique boulder foot-bridge of five arches, just at the northern end of the hemlock forest was built from designs by the same engineer. The concrete-steel bridge spanning the gorge of the Bronx below the waterfall was built by the Park Department; and the sixth bridge in the plan is a foot-bridge, temporarily built of wood, ultimately designed in concrete, crossing the Bronx River in the north meadows.

The bridge dedicated to Linnaeus, which carries the Pelham Parkway across the river, is appropriately located between the Botanical Garden and the Zoological Park.

27. Water Supply and Drainage

The water supply has also been constructed in accordance with the general plan and the system has been extended from year to year as the development of the grounds proceeded. Drinking fountains and public comfort stations have been erected at various points.

The drainage of the grounds has been carried out in accordance with a well-studied original plan, which provides outlets for the surface drainage for the most part either into the lakes or into the river, very little of it being taken into the sewers. Only a small portion of the drainage system still remains to be built.

28. Shade Trees and Border Screens

The park treatment further calls for the planting of shade trees where these are needed along the driveways,

and much of this has been done, a great many kinds of trees having been used, and many shrub plantations have been set out, especially at roadway and path intersections, utilizing considerable numbers of the same kinds of shrubs at different points.

The general planting plan includes provision for partially surrounding the grounds, except at entrances, with border screens. This planting has already been accomplished along the western and northern boundaries, and partly along the southern and eastern boundaries. These screens are composed of a very great variety of trees and shrubs, variously grouped, and average about fifty feet in width.

29. Shelters and Pergolas

Only a few of these ornamental, as well as useful, structures have been erected, but the plan of development includes a number of them, and also several decorative fountains.

Lakeside Shelter

A concrete shelter-house stands by the path on the southwestern side of the upper lake, which lies just west of the water garden. The southern and eastern banks of this lake are decorated with masses of rhododendrons, mountain laurel, and other shrubs and trees.

Herbaceous Garden Pergola

A small, hexagonal, concrete pergola stands in a triangle formed by three paths in the forest edge on the eastern side of the herbaceous garden.

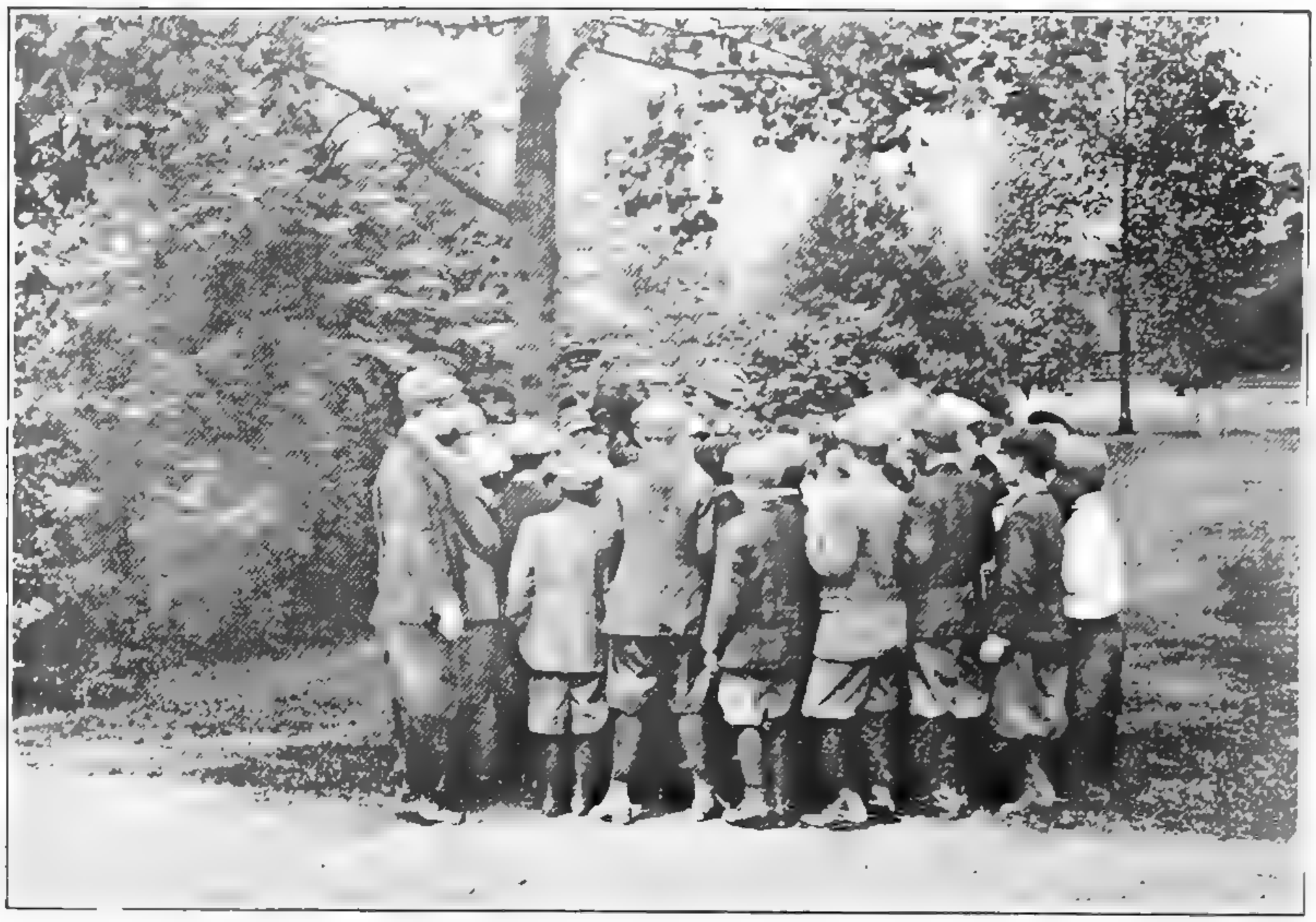
School Garden Shelter

This was completed in 1918 with funds contributed by Mrs. Frederick Ferris Thompson. It is very attractively located on a high rocky cliff overlooking Long Lake and the valley containing the Rose Garden.

UPPER LAKE AND LAKESIDE SHELTER

SCHOOL GARDEN SHELTER

PART OF THE BORDER SCREEN



DOCENTRY

Docentry

In order to provide a method for viewing the collections under guidance, a member of the Garden staff leaves the front door of the Museum Building every week-day afternoon at 3 o'clock, to escort all who may wish to accompany him. The routes are as follows:

Monday: Hemlock Forest, Mansion, and Herbaceous Garden. Tuesday: Pinetum. Wednesday: Fruticetum and North Meadows. Thursday: Deciduous Arboretum, Nurseries and Propagating Houses, and Public Conservatories, Range 2. Friday: Public Conservatory Range 1. Saturday: Museums.

Rules

1. The picking of flowers, leaves, fruits, nuts, or the breaking of branches of any plants, either wild or cultivated, the uprooting of plants of any kind, the defacing of trees, and the carrying of flowers, fruits or plants into or from the grounds of the Garden, are prohibited, except by written permission of the Director-in-Chief of the Garden.

2. Leaving or depositing paper, boxes, glass or rubbish of any kind within the grounds of the Garden is forbidden.

3. Dogs are not allowed within the limits of the Garden except in leash.

4. It is forbidden to take fish from within the Garden, or to molest in any way squirrels, birds, snakes, frogs, toads, turtles or any other wild animals.

5. Throwing stones or other missiles, playing ball, football, tennis, or other game is prohibited.

6. It is forbidden to offer for sale food, candy, newspapers, books, tobacco, beverages, flowers or any other objects, without written permission from the Director-in-Chief and the Commissioner of Parks for the Borough of The Bronx.

7. Boating or rafting on the ponds, lakes, and streams is forbidden.

8. Trucking, or the driving of business wagons of any kind, is forbidden on the roads of the Garden, except on those designated for such purposes.

9. It is forbidden to accept or solicit passengers for any cab, carriage, or other conveyance, at any point within the grounds of the Garden without written permission from the Director-in-Chief of the Garden and the Commissioner of Parks for the Borough of The Bronx.

10. Visitors are not allowed within the Garden after eleven o'clock at night nor before six o'clock in the morning except upon driveways and paths designated for their use between those hours.

The Garden is also protected by all city ordinances referring to the Park System.

EXPLANATION OF MAP

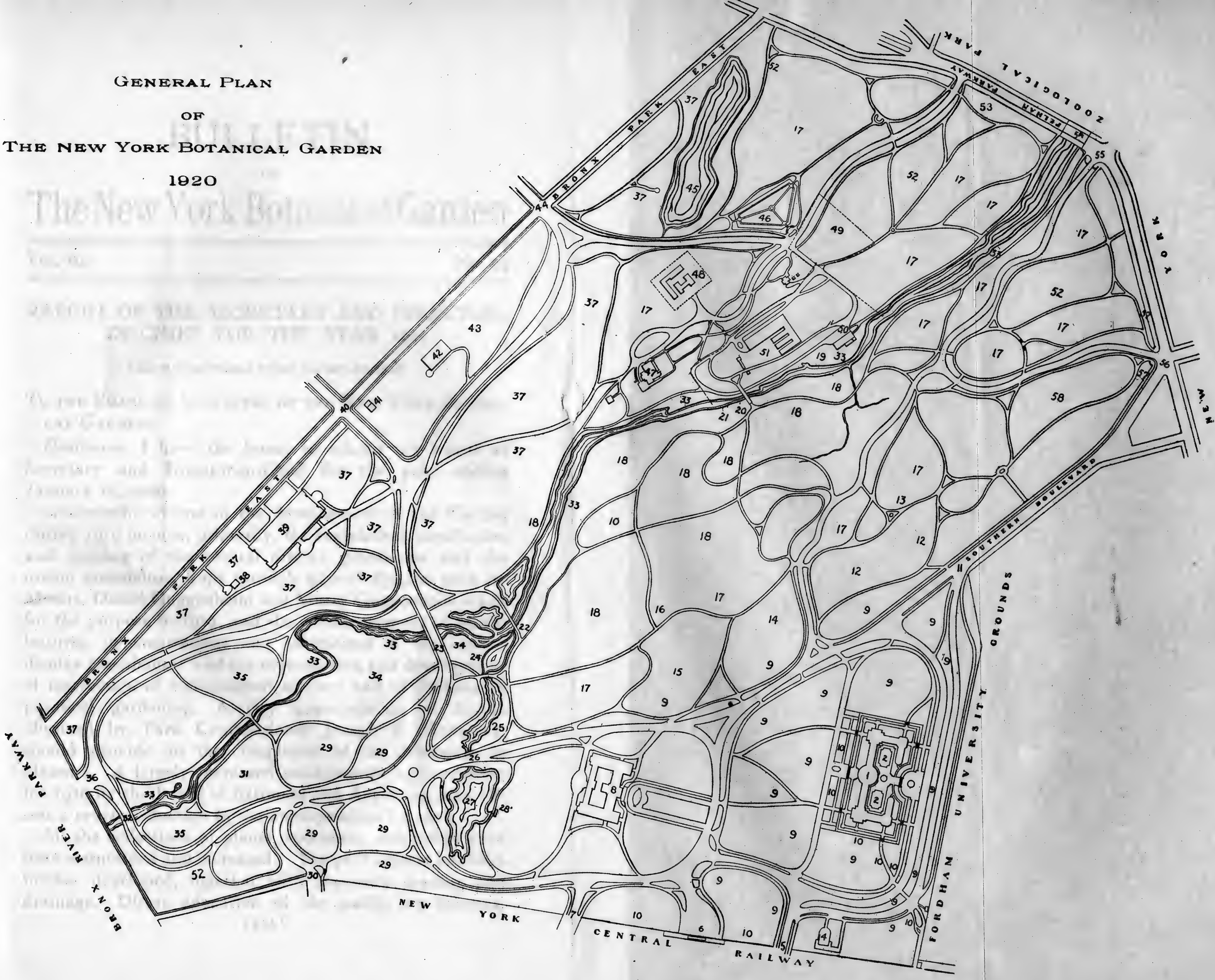
1. Public Conservatory Range 1
2. Water-lily Tanks
3. Elevated Railway Station
4. Power House No. 1
5. Bedford Park Entrance
6. Botanical Garden Station
7. Mosholu Parkway Entrance
8. Museum Building
9. Pinetum
10. Flower Gardens
11. Southern Boulevard Entrance
12. Herbaceous Garden
13. Pergola
14. Morphological Garden
15. Economic Garden
16. Viticetum
17. Deciduous Woodlands
18. Hemlock Forest
19. Gorge of the Bronx River
20. Gorge Bridge
21. Waterfall
22. Boulder Bridge
23. Long Bridge
24. Lower Lake
25. Water Garden
26. Lake Bridge
27. Upper Lake
28. Lakeside Shelter
29. Fruticetum
30. Woodlawn Road Entrance
31. Salicetum
32. North Bridge
33. Bronx River
34. River Woodlands
35. North Meadows
36. Bronx River Parkway Entrance
37. Deciduous Arboretum
38. Power House No. 2
39. Public Conservatory Range 2
40. Allerton Avenue Entrance
41. Stable
42. Propagating Houses
43. Nursery and Experimental Gardens
44. Arboretum Entrance
45. Long Lake
46. Rose Garden
47. Mansion
48. Park Department Barn
49. Park Department Band Stand
50. Park Department Shop
51. Park Department Greenhouses
52. Picnic Grounds
53. Mansion Entrance
54. Linnaean Bridge
55. Linnaean Bridge Entrance
56. Iris Garden Entrance
57. Iris Garden
58. White Pine Plantation

General Plan

of

The New York Botanical Garden

1920



BULLETIN
OF
The New York Botanical Garden

Vol. 10 No. 39

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1919

(*Accepted and ordered printed January 12, 1920*)

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: I have the honor to submit my report as Secretary and Director-in-Chief for the year ending January 12, 1920.

Noteworthy events in the development of the Garden during 1919 include, primarily, the completion, installation and opening of the central display greenhouse and the orchid greenhouse, built through gifts of $50,000 each by Messrs. Daniel Guggenheim and Murry Guggenheim made for the purpose in 1917, and the commencement of public lectures, demonstrations and exhibitions in the central display greenhouse; and the organization and development of instruction of convalescent soldiers and of civilians in practical gardening. A city appropriation of $5,000 obtained by Park Commissioner Joseph P. Hennessy, should provide for the completion of the driveways as planned. A largely increased maintenance appropriation for 1920 by the Board of Estimate and Apportionment offsets a severe reduction in the appropriation for 1919.

All the collections of plants, specimens and books have been maintained and increased. The path system has been further developed, together with necessary grading and drainage. Direct education of the public by lectures,

demonstrations and docentry has been continued and expanded. No deterioration in the beautiful natural features of woodlands, river banks, valleys, glades, hills and meadows has been experienced, and planted trees and shrubs have been maintained in health and elegance.

Botanical exploration has been accomplished in British Guiana, Cuba, Jamaica, the Bahamas, and Florida, with resultant valuable additions to the collections and in contributions to knowledge. Scientific investigation over a wide range of subjects has been prosecuted by students, by visitors, and by members of the staff.

The collections of living plants in the open and under glass include about 14,600 kinds, a net increase during the year of about 100 kinds, mostly in horticultural races and varieties. The library was increased by about 450 volumes through gifts, purchases and exchanges, the total number of bound volumes now reaching about 29,700. Museum and herbarium specimens added during the year by gift, purchase, exchange and exploration, aggregate about 9,000.

Publications of 1918–19 include No. 37 of the *Bulletin*, commencing Volume 10; Volume 20 of the *Journal;* Volume 11 of *Mycologia;* 1 part of *North American Flora;* 7 numbers of *Contributions;* and the fourth volume of *Addisonia.*

The completion of additional coal bunkers at both power houses provides largely increased coal storage. The construction of the cherry garden shelter was commenced in the autumn and may be completed during the winter. Bequests of $5,000 by Mrs. Mary J. Kingsland and of $30,000 by Mrs. Samuel W. Bridgham were announced during the year. The bequest of Mrs. Russell Sage announced last year has been appraised at $776,586.

Plants and Planting

All the existing plantations described in some detail in my last annual report have been maintained, variously modified. New plantations of great interest were installed in the central display greenhouse.

The collections in the herbaceous garden valley were increased by native American species collected by Dr. E. B. Southwick and by Dr. F. W. Pennell. A few kinds of shrubs were added to the fruticetum and some trees to the arboretum; the list of hardy woody plants prepared by Mr. George V. Nash and published in successive issues of the *Journal* is approaching completion, after necessary interruption and delay. Water gardens and the iris garden remain essentially unmodified; we have prepared plans for a new iris garden much more extensive than the existing one, which may be constructed and installed in cooperation with the American Iris Society when funds for the purpose become available; the cordial cooperation of the American Iris Society has been secured by Dr. Gleason. The young forests of white pine and red pine planted in 1916 and 1918 respectively, in cooperation with the Conservation Commission of the State of New York, continue to grow satisfactorily and are of much interest to the public as demonstrating forest planting. Large collections of gladioli, cannas, rose mallows and phloxes were grown in the horticultural gardens, and a special group of plants with variegated foliage was added. Collections of peonies and lilacs for planting in the new lilac and peony garden along the Pelham Parkway have been brought together, but their installation there awaits necessary ground improvements.

The rose garden developed in cooperation with the Horticultural Society of New York has received additional named kinds of bush roses; construction of path approaches with necessary grading accomplished during the past season now permits planting the collection of rambling roses; provision for the climbing roses is yet to be made. The school garden developed in cooperation with the International Children's School Farm League has been enlarged and used in the instruction of convalescent soldiers; an additional plot just south of the nurseries was also used for this purpose; the increasing number of students in gardening now requires the preparation of addi-

tional land. Both plots required woven wire fencing and also guarding to prevent fruits and vegetables being taken by interested citizens. Plans for the formal garden just south of the mansion remain unused, awaiting funds for construction. The extensive flower gardens around conservatory range 1, extending along paths and border screens to the railroad have been maintained with slight modification. The large and elegant dahlia collection brought together by Curator Marshall A. Howe, along the border screen north of the railroad station, was notably increased and flowered profusely from August until killed by frost on November 10. Hardy chrysanthemums were brought together along the border screen south of the railroad station; the border screen was found to throw rather too much shade for their best development, and it is planned to move this collection to the horticultural gardens, or to establish another collection of chrysanthemums there. The nurseries and propagating grounds south of the propagating houses were maintained with some reduction of area under cultivation.

Following the reopening of conservatory range 2, closed for over a year owing to coal shortage, and the opening of the new greenhouses added to that range by the gifts of Daniel and Murry Guggenheim, extensive rearrangements were made of the plants under glass. Large collections were moved from range 1 to range 2; the palm collection, long crowded mostly in two greenhouse compartments, was further distributed; all the tropical ferns, orchids, and most of the cycads were taken from range 1 to range 2, and many specimens stored in the propagating houses were made available for examination by the public in the two large ranges. The educational value of the greenhouse collections has thus been greatly increased. One of the propagating houses has been used in the teaching of convalescent soldiers, another by the Director of the Laboratories for experimental work with students, and the third contains a large portion of the collection of cacti.

Details of plants and planting will be found in the report of the Head Gardener hereto appended.

Museums

The revision and cataloguing of the specimens forming the economic museum commenced last year by Dr. H. H. Rusby, Honorary Curator, was continued by him at intervals during the year, but it was not found possible to complete the catalogue for printing, this task proving too great for the time at his command. His report hereto appended indicates that this very important work may soon be finished.

A considerable modification was made in the systematic museum on the second floor of the museum building by moving the cases and their contents from the western wing to the adjoining hall, and thus making the western hall available for the herbarium specimens of fungi moved from the upper floor of the building to relieve congestion there; laboratories and offices for the Supervisor of Public Instruction, Dr. Murrill, and for Curators Seaver and Howe were provided, and the herbarium collections of algae still on the upper floor will be moved to the second floor as soon as possible. The microscopic exhibits set up for the use of the public in the west wing were moved to the mezzanine floor in the middle of the building, readjusted and renewed.

The museum of fossil plants on the basement floor of the museum building has been somewhat increased as recorded in the report of the Honorary Curator of Fossil Plants, Dr. Hollick, hereto appended; his investigations of fossil plants of the West Indies were continued. No essential change was made in the display series of specimens. Additional cases here would permit the exhibition of many interesting specimens now in storage.

Some 24,000 herbarium specimens previously mounted and held in storage were incorporated into the permanent collections, this requiring almost all the case room avail-

able. Additional herbarium cases are now greatly needed to properly conserve specimens more recently obtained or stored. Full details of the museum and herbarium work will be found in the report of the Head Curator hereto appended.

The catalogue of the extensive series of lantern slides and photographic negatives has been made complete by Mrs. Grace M. Schilling, appointed to succeed Miss Elsie M. Kittredge, Assistant Curator, resigned. Mrs. Britton has given continued attention to increasing the collection of lantern slides, especially of plants not hitherto represented. Mrs. Mortimer J. Fox continued voluntary work on the collection of prints and other illustrations of plants and has put this valuable series in excellent condition for reference. Contributions to the Emergency Fund were credited to the purchase of specimens as follows:

Mr. Edwin A. Richard	$250
Mr. Henry W. de Forest	100
Mr. Eugene P. Bicknell	25
Professor William J. Gies	25

Library

As shown by the report of the Librarian hereto appended, the library was increased during the year by 450 volumes, this collection of books now comprising about 29,700 volumes. Other requirements precluded the expenditure of as much money for the purchase and binding of books as we had hoped for at the beginning of the year. Contributions to the Emergency Fund were credited to the purchase of books as follows:

Mr. Andrew Carnegie	$500
Mr. Mortimer L. Schiff	100
Mr. Felix M. Warburg	100
Mrs. F. F. Thompson	100
Mr. E. E. Olcott	10

Liberal expenditure for book purchases remains as an important item to be accomplished, and has received special consideration by the Scientific Directors. We still need a

library fund with an income of $2,000 or more annually, specified for books and binding, and there is also need at the present time for additional book shelving.

For details of library work reference is made to the reports of the Librarian, Miss Harlow, and of the Bibliographer, Dr. Barnhart.

Public Instruction and Information

Instruction by public lectures and demonstrations and by docentry has been continued, all members of the staff participating. Following the suggestion in my last annual report, the position of Supervisor of Public Instruction was established in January, 1919, and Dr. William A. Murrill, formerly my First Assistant, was appointed to fill it. Under his direction, educational work, especially in docentry, has been expanded, and he has delivered lectures on various topics at the Garden and elsewhere. He was placed in charge of a very successful exhibition of plants used in decorative design held at the Metropolitan Museum of Art in March and April, in cooperation with that institution. The completion of the central display greenhouse, given by Messrs. Daniel and Murry Guggenheim, including space for public lectures and exhibitions, provided important additional facilities for lectures delivered there on Saturday afternoons in November, to be continued. At the November meeting of the Board of Managers, a series of Sunday afternoon lectures, in addition to the Saturday courses, was authorized, and these will be commenced in the spring. Dr. Murrill's report hereto appended gives details of the public educational work.

Replies to all requests for botanical information have been continued and all questions, oral or written, have been replied to; these questions have been numerous and the correspondence of the institution continues very large.

Instruction of Convalescent Soldiers in Practical Gardening

Pursuant to correspondence and consultation by President Thompson with officials of the Federal Board for Vocational Education, arrangements were made early in the year for training in practical gardening wounded, crippled or otherwise disabled men who had served in the war with Germany for the preservation of democracy. The first student under these arrangements was admitted on January 16, and others were received from time to time. The number under instruction at the date of this report is 45; the total number enrolled to date is 57; 4 were transferred to other institutions; 3 were sent to hospitals; 4 left for unknown reasons; and one was lost by death.

Mr. Kenneth R. Boynton, formerly Head Gardener's Assistant, and who was in service during the war as a corporal, was appointed Marshal of the Garden School in February and put in charge of the details of the instruction and discipline; in October, subsequent to the resignation of Captain Henry G. Parsons, who had been absent on leave for government service during the war, Mr. Boynton succeeded him as Supervisor of Gardening Instruction. In July, Mr. Walter B. Balch, a recent graduate of Cornell University, was appointed to succeed Mr. Boynton, and we have just appointed Mr. E. E. Watson, from the University of Michigan, as another assistant. Gardeners have been detailed for work in instruction as needed from time to time.

Officials of the Vocational Board have continually inspected the work of instruction and have made important suggestions; they propose to increase the number of soldiers sent for this training, and in this event additional instructors will be required.

This vocational work was primarily established through the following contributions to the Emergency Fund of 1919:

Dr. and Mrs. N. L. Britton	$1,000
Mr. W. J. Matheson	250
Mrs. Mortimer J. Fox	200

Mrs. Delancey Kane	100
Mrs. George W. Perkins	100
Mrs. Gustav E. Kissel	100
Mr. and Mrs. Bernhard Hoffmann	100
Mr. Samuel W. Fairchild	50

At the request of the International Children's School Farm League, an unexpended balance of $3,263.62 of the fund provided by that organization in 1917 to support the training of teachers of school gardens for two years, was transferred to the training of convalescent soldiers. These contributions and this transfer, together with $15 per month paid for each soldier student by the government, have sufficed to organize, equip and maintain the instruction.

All members of the Garden staff have cooperated by lectures, laboratory work, field instruction and otherwise. The training of the convalescent soldiers thus took on a broad and diversified character. Mr. Boynton's report hereto appended gives a complete record of this interesting work, together with a list of students and their disabilities.

We have had numerous requests from various sources for these students, one employer stating that he could use the whole school, but their training has not yet been sufficient to warrant placing any of them in positions.

Instruction of Civilians in Practical Gardening

Subsequent to the organization of the instruction for convalescent soldiers in practical gardening, this instruction was extended to civilians, both men and women, and this educational tender was widely advertised. During 1919, 2 women and 1 man were enrolled, and 1 woman and 3 men have been admitted in January. A special course for women desiring training for work in their own gardens has just been commenced, with an attendance of 10. The development of a permanent school of gardening has been given much consideration by the Scientific Directors and a plan outlined by Dr. Gleason has been approved by them, subject to confirmation by the Board of Managers.

Exploration and Collecting

The necessity of applying all available funds to maintenance has restricted exploration work to near limits. The following contributions to the Emergency fund were credited to exploration:

Mr. Edward V. Z. Lane	$100
Mr. Charles F. Rand	100
Mr. Edgar L. Marston	100
Mr. Adolph Lewisohn	50

Through the cooperative arrangement entered into in 1917 with the Smithsonian Institution and the Gray Herbarium of Harvard University, for exploration and investigation of the flora of northern South America, Professor A. S. Hitchcock, Agrostologist of the United States Bureau of Plant Industry, was commissioned during the summer to explore portions of British Guiana for a period of about six months. He reports extensive collections already made, which will doubtless add much to our knowledge of tropical American vegetation and its products. The study and organization of collections made in Colombia, Venezuela and Ecuador under this arrangement has progressed to such extent as the available time of members of the staff of the three cooperating institutions has permitted; in order to proceed more rapidly, additional investigators and collectors are needed.

Through the continued valued patronage of Mr. Charles Deering, botanical exploration of southern Florida was continued during the year by Dr. John K. Small, Head Curator, who visited that region during parts of April and May, and again in December, and made large collections of specimens and of living plants. Mrs. Britton and I accompanied Dr. Small in December and took part in the work, which enabled us to restudy the vegetation of Florida in relation to that of the Bahamas, Cuba and Porto Rico. For additional facilities in this investigation, we are grateful to Mr. William J. Matheson, of the Garden Board of Managers, and to his son, Mr. Hugh M. Matheson. We

gave especial attention to collecting the lichens of the region for comparison with those of the West Indies and to the study of plants collected in gardens, parks and nurseries, some of which we secured for our greenhouse.

Some collecting for the local herbarium was done by members of the staff in northern New York, Connecticut and New Jersey.

Our West Indian collections have been further increased by specimens collected by Mr. William Harris in Jamaica, by Brother Léon and Brother Hioram in Cuba, and by Mr. L. J. K. Brace in New Providence, Bahamas.

Roads and Paths

Pursuant to our request for a special appropriation of $5,000 for completing the unfinished driveway through the eastern part of the reservation, referred to in my report for the year 1918, this amount was granted during the summer by the Board of Estimate and Apportionment, after application by Hon. Joseph P. Hennessy, Commissioner of Parks of the Borough of The Bronx, and was made available for expenditure late in November. Work in grading, rock excavation and paving northeast of the rose garden was immediately begun by a force of workmen of the Park Department, and continued until December 31. All grading was completed during this period and all but about 200 feet of road area was paved; enough stone to complete this paving is readily available and work may be resumed within a short time. Provision is made in the city appropriation for supplying and rolling in the broken stone and screening required to complete the work, also for oiling the surface; we may therefore anticipate the completion of this much needed driveway in the spring. It will be recalled that our plan contemplates the closing of the narrow dangerous road leading north from the Mansion after the new broad driveway is opened for traffic.

At conservatory range 2, the plaza at the west end of the central display greenhouse was materially enlarged in

order to get better turning and parking space for motor cars.

High-grade maintenance of the driveways has been continued by Park Commissioner Hennessy and his able staff, under the provisions of the Garden's Charter.

Construction of additional portions of the path system in various parts of the grounds with collateral grading and drainage and subsequent planting was accomplished by means of contributions to our Emergency Fund credited to grounds improvement, as follows:

Mr. Edward S. Harkness	$500
Mr. J. P. Morgan	500
Mr. Henry C. Frick	500
Mr. Daniel Guggenheim	250
Mr. Murry Guggenheim	250
Mr. George W. Perkins	250
Mr. Cleveland H. Dodge	250
Mrs. James A. Scrymser	250
Mr. Edward D. Adams	200
Mr. Emerson McMillin	100
Mrs. Henry O. Taylor	100
Mrs. Robert Bacon	100
Mr. Robert W. de Forest	100
Dr. Lewis Rutherfurd Morris	100
Mr. Louis C. Tiffany	100
Mr. Myles Tierney	100
Mrs. George D. Pratt	100
Mr. Fritz Achelis	100
Mr. George F. Baker	100
Mrs. E. H. Harriman	100
Mr. William Sloane	100
Mrs. Charles D. Dickey	100
Mr. W. K. Vanderbilt	100
Mr. C. A. Coffin	50
Mr. T. A. Havemeyer	50
Mr. George Blumenthal	50
Mr. Henry R. Hoyt	50
Mrs. Theron G. Strong	50
Mr. A. F. Estabrook	50
Mrs. George A. Armour	50
Mrs. Hamilton Fish Kean	50
Mr. A. R. Shattuck	25
Mrs. Thomas H. Barber	25
Mr. Frederick Strauss	25

Mr. J. Montgomery Hare	$25
Mrs. Harold I. Pratt	25
Col. Samuel P. Colt	25
Mrs. V. Everit Macy	10
Mr. John W. Auchincloss	10
Miss Elizabeth Billings	10

Unfinished paths in the arboretum, through the collections of magnolias, oaks and birches, aggregating about 500 feet in length, 10 feet wide, were surfaced by ashes from the power houses and opened to the public. A path 510 feet long, 10 feet in width, extending south from the rose garden stairway along the ridge overlooking the rose garden from the west, was completely graded and partly paved. Work is progressing here during the winter and this much needed path may be completed and put into use early in the spring. Paths on both sides of the driveway leading from the iris garden entrance to the mallow garden were completely graded and partly paved; these, 10 feet in width and over 1,200 feet in length, also provide much needed connections; work here is also progressing and both paths may be opened in the spring. A path 200 feet long and 10 feet wide, along the southern side of the war memorial grove of Douglas spruce, was completed and opened at the time that plantation was established in the spring. Path approaches to conservatory range 2 from the north and to the cherry garden shelter from the east and south, 10 feet wide and aggregating about 800 feet in length, were partly graded; the top-soil obtained was used in forming the planting spaces in the central display greenhouse nearby. Work upon these paths may be continued next season when funds become available.

The next most important paths to develop are the connection of the Linnaean Bridge entrance northward along the west side of the Bronx River to the gorge bridge in the hemlock grove and the companion path on the east side of the river north to the Lorillard snuff-mill, denominated the Bronx River paths; some grading and paving was accomplished upon these in former years; their completion

will be a great boon to the visiting public, affording restful and beautiful views of the quiet reaches of the river.

Water Supply

Work was commenced in the autumn and is being continued during the winter in providing the high pressure water supply needed at the mansion, referred to in my last annual report, designed to provide running water on the third floor of that building; the increased use of the mansion for instruction of convalescent soldiers and of civilians in gardening makes a better water supply necessary. We purchased the 4-inch water pipe necessary and have done most of the earth excavation for the trench; rock excavation for a distance of about 100 feet is in progress and we hope to complete the principal connection within a few weeks; a short connection requiring 3-inch water pipe at the mansion still needs a few days' work.

Buildings

Reference has already been made in this report to the central display greenhouse and the orchid greenhouse added to conservatory range 2 through the gifts of Messrs. Daniel Guggenheim and Murry Guggenheim, and to the reoccupation of the other greenhouses of this range, which were closed for over a year by reason of coal shortage; necessary repairs were made to the roofs of the older houses of this range. Much repair work was found necessary at conservatory range 1, including painting, replacement of glass, reconstruction of benches, and replacement of sash bars. Available funds did not suffice for completing all repairs desirable and this work must be continued during the coming year. At the propagating houses, some absolutely necessary repair work was done, but all the plant benches in these houses need replacement in concrete, which we are proceeding to accomplish as soon as possible; some painting is also required here.

The museum building required repairs to the roof and

the replastering of the interior walls; considerable replastering still remains to be done. One of the piers in front of this building has settled and cracked, and this requires rebuilding. The collective amount of repair work necessary demands large expenditure during the coming year.

We built a new coal bunker at power house 1, using stone for its walls obtained from the necessary excavations at conservatory range 2, and utilized the earth excavated for filling up an unsightly swale along the Southern Boulevard at the horticultural gardens. All the masonry and concrete work of the new cherry garden shelter was completed, the woodwork for the roof of this structure has been ordered, and we hope to complete it by the time the cherry garden comes into flower in the spring. Only minor repairs have been necessary on the smaller buildings and these, as well as the bridges, are in good condition. Details of the work on roads and paths, grading, drainage, water supply and buildings will be found in the report of the Superintendent of Buildings and Grounds hereto appended.

Victory Bonds

Employees of the Garden were enabled to subscribe to the Victory Loan in the same manner as to the issues of liberty bonds, payable in installments. The Treasurer purchased $8,000 of the Victory Loan to cover subscriptions by the following employees:

G. K. Ackerman, Jr., Clerk
C. J. Auld, Gardener
John H. Barnhart, Bibliographer
Henry W. Becker, Foreman Gardener
Kenneth R. Boynton, Supervisor of Gardening Instruction
N. L. Britton, Director-in-Chief
John Caffrey, Keeper
B. Cassell, Laborer
T. Chadwick, Gardener

A. J. Corbett, Superintendent of Buildings and Grounds
James Curry, Laborer
John Farley, Fireman
Thomas Feltham, Soldier Student
Frank Finen, Fireman
James Finley, Gardener
John Finley, Foreman Gardener
George Friedhof, Gardener
Henry Friedman, Clerk
August Gleasel, Gardener
H. A. Gleason, First Assistant
W. S. Groesbeck, Bookkeeper
Dorothy Hale, Museum Aide
Sarah Harlow, Librarian
Marshall A. Howe, Curator
Owen Keefe, Gardener
Robert McAvis, Driver
W. J. McGreevy, Head Steam Engineer
James Malley, Driver
Edward W. Meyer, Laborer
John J. Millard, Janitor
J. Moore, Gardener
George Morse, Night Watchman
D. Murphy, Laborer
George V. Nash, Head Gardener
Hugh F. O'Neill, Soldier Student
George Purdy, Painter
Jacob Radlein, Gardener
J. G. Rechsteiner, Plumber
P. A. Rydberg, Curator
F. A. Schilling, Museum Custodian
Fred J. Seaver, Curator
Harry Shafer, Gardener
Theodore Shaffer, Steam Engineer
John K. Small, Head Curator
Charles Smith, Gardener

John Sommer, Gardener
E. B. Southwick, Custodian, Herbaceous Grounds
A. B. Stout, Director of the Laboratories
Florence M. Willey, Stenographer
Ralph A. Willey, Driver
R. S. Williams, Administrative Assistant
Roland E. Wills, Steam Engineer

Natural Features

Continued care has been taken of the natural woodlands, thickets, meadows and other features and they have suffered no serious deterioration of their original beauty; their only destructive enemies have been individuals of the human species, and these have been controlled for the most part by our keepers. Some vandalism has been experienced, but not sufficient to mar natural attractions to any serious extent. Parts of the woodlands still require additional guard rails along paths and trails.

Reports Appended

I append reports made to me by Dr. Gleason, First Assistant; by Dr. Small, Head Curator; by Dr. Murrill, Supervisor of Public Instruction; by Mr. Nash, Head Gardener; by Dr. Stout, Director of the Laboratories; by Mr. Boynton, Supervisor of Gardening Instruction; by Mr. Corbett, Superintendent of Buildings and Grounds; by Dr. Barnhart, Bibliographer; by Miss Harlow, Librarian; by Dr. Hollick, Honorary Curator of Fossil Plants; by Mrs. Britton, Honorary Curator of Mosses; by Dr. Rusby, Honorary Curator of the Economic Collections; and a schedule of expenditures by Mr. Groesbeck, Bookkeeper.

Respectfully submitted,
N. L. Britton,
Director-in-Chief

REPORT OF THE FIRST ASSISTANT

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my first annual report as First Assistant.

On reporting for duty at the New York Botanical Garden February 10, I learned that no *ex officio* duties were attached to my position, and I was charged by you with various administrative and executive duties. Some of these have been merely routine matters, such as attending to correspondence, and overseeing the work of certain employees, and require no special mention in this place.

The editorship of the *Journal* of the New York Botanical Garden, which had been assigned to Dr. Francis W. Pennell, associate curator, was transferred to me with the February issue. The twelve numbers for the year include 258 pages, 17 full-page half-tone plates, and 1 text figure in zinc. Although copy has been sent to the printers regularly on the 25th of the month preceding, only two numbers have appeared within the month of issue. Much good can accrue to the Garden by the prompt publication of a well-written and well-illustrated magazine. I would respectfully recommend the enlargement of the *Journal*, when funds are properly available, to an average size of 48 pages and 4 to 8 plates per issue, with the extension of its scope to include any botanical and horticultural articles of interest to the members of the Garden, and believe that the increase in membership of the Garden due to the *Journal* would in a short time be sufficient to carry the extra expense.

As a result of negotiations begun in 1918, a report of which has been published in the *Journal* (**20**: 51–61), a course of instruction in gardening was established in January. Its development, under the immediate supervision of Mr. Kenneth R. Boynton, Supervisor of Garden Instruction, has proceeded steadily throughout the year. In this development I have aided with advice on the arrangement of the curriculum, on the scope and content

of the various courses, and on many details of administration. I have also acted as the intermediary with the Federal Board for Vocational Education, handling most of the correspondence and business.

In an attempt to attract to the courses in garden instruction a number of civilian students, a small advertising campaign has been conducted. Notices briefly describing the courses and the opportunity were inserted in *The Garden Magazine*, *The Gardeners' Chronicle*, *The Florists' Exchange*, and *Horticulture*. These have brought some hundreds of replies, but only seven actual registrations. Others are expected for the early part of 1920, but in general the advertising campaign has been a failure.

The numerous replies have demonstrated beyond a doubt that there is a widespread interest in garden instruction, and have led me to the conclusion that the lack of registration is due to some defect in our plan. Acting on this conclusion, I have formulated a new plan for the administration of the instruction in gardening, which has already been approved in principle by the Scientific Directors, and which will be presented to the Board of Managers for final action.

For three months during the summer, a small advertisement of *Addisonia* was inserted in *The Garden Magazine*. Again many replies were received, and four new subscriptions followed, which were enough to make the advertising distinctly profitable, although leading me to believe that some changes in our present method of publishing *Addisonia* might result in a much larger subscription list.

Inspired by the success of the exhibition of plant forms used in design, held at the Metropolitan Museum of Art, a competition in the use of plants in decorative design was held at the Mansion in April, and was participated in by 26 art students of the city. A detailed account of this has been published in the *Journal* (**20**: 124–126).

The annual spring inspection of the Garden was held May 1.

The new Central Display Greenhouse, the gift of Messrs. Daniel Guggenheim and Murry Guggenheim, was formally opened to the public November 8. Its unique facilities were immediately taken advantage of by a short series of greenhouse lectures on the three following Saturdays.

The proper heating of the Museum Building still continues an unsolved problem. The increased demands of Conservatory Range 1 at night makes it necessary to shut off steam from the Museum after working hours, and on cold days it is impossible to bring the temperature of some rooms in the Museum to a comfortable temperature. This condition has been aggravated by the shortage of coal at some periods of the year, and can never be fully remedied except by radical changes in the heating system.

Monthly conferences of the staff and students of the Garden have been held as usual on the first Wednesday of each month, except during the summer. The Torrey Botanical Club has continued to hold one meeting each month in the Museum Building. One special meeting of the Club in connection with the Wild Flower Preservation Society was held at the Mansion. The New York Microscopical Society held a field meeting at the Garden in June. Exhibitions of flowers and plants by the Garden and the Horticultural Society of New York, jointly, have been held as usual. Of these the last was held in the Central Display Greenhouse, which is remarkably well adapted to such exhibitions.

Our three periodicals, the *Journal*, *Mycologia*, and *Addisonia*, have appeared regularly, as reported to you by other members of the staff. One number of the *Bulletin* has appeared (volume 10, number 37), comprising pages 1 to 87, and containing the annual reports for 1918. Seven articles have been reprinted as Contributions, as follows:

No. 208. Notes on Plants of the Southern United States—V., by Francis W. Pennell.

No. 209. Intersexes in *Plantago lanceolata*, by A. B. Stout.

No. 210. The Genus *Desmatodon* in North America, by R. S. Williams.

No. 211. Phytogeographical Notes on the Rocky Mountain Region—VIII. Distribution of the Montane Plants, by P. A. Rydberg.

No. 213. Taxonomic Studies in *Vernonia* and Related Genera, by H. A. Gleason.

No. 214. A brief Conspectus of the Species of *Kneiffia*, with the Characterization of a New Allied Genus, by F. W. Pennell.

No. 215. Tulip Droppers, by A. B. Stout.

These include 106 pages and 3 plates. Contribution number 212 is begun and awaits completion during 1920.

With the approval of the Scientific Directors, I have begun supplying brief botanical notes and articles of general interest to the Scientific American, with the cooperation of other members of the staff. Actual publication of this matter is expected at an early date.

For many years there has been in America a growing interest in the cultivation of the various species of Iris, culminating in the suggestion, frequently expressed, of an Iris Society with trial grounds and exhibition garden. I have entered into this movement in cooperation with several leading Iris growers, and a society will soon be organized. In all probability, the society will wish to establish its first gardens on our grounds, and the Scientific Directors have already expressed their approval of this plan. Under this arrangement the Garden may soon have the largest and most complete collection of Iris in America, without any cost other than the preparation of the ground and the maintenance of the collection.

In my personal research, I have finished and published several small articles for which data had been secured prior to my connection with the Garden, and have prepared the manuscript for that part of North American Flora dealing with the tribe Vernonieae of the family Carduaceae. I have also begun the examination of our

herbarium material of the lobeliaceous genera *Centropogon* and *Siphocampylus*, and this work will be continued in 1920 as time permits.

In connection with the public lectures of the Garden, I have delivered three lectures in the lecture hall of the Museum Building and one in the Central Display House of Conservatory Range 2.

Respectfully submitted,

H. A. GLEASON,
First Assistant.

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit herewith my report as Head Curator of the Museums and Herbarium for the year 1919.

The collections, comprising the public exhibits and the research material, have been cared for and developed as in previous years. Specimens were received from various sources and were accessioned in detail, from month to month, in the *Journal*. The accessions for the year may be summarized as follows:

By gift and purchase	2,399
By exchange	3,133
By exploration	3,826

Thus all together 9,358 specimens were brought together for the public exhibits and the research collections. The value of the specimens received as gifts is estimated at $346.70. About 5,050 duplicate herbarium specimens were sent to other institutions as exchanges.

Museums

The collections of the public museums were both enlarged and rearranged. No new equipment was added.

THE ECONOMIC MUSEUM. Numerous specimens were added nearly throughout the public exhibits of this museum. The interpolation of specimens necessitated the rearrangement of the contents of nearly every exhibition case. For

details see report of the Honorary Curator of the Economic Collections.

THE SYSTEMATIC MUSEUM. Specimens were added to all divisions of this museum and selected ones were interpolated in the public exhibits. The setting aside of the west wing for herbarium and office purposes necessitated the removal of the exhibits from that hall into the west hall, as well as a complete rearrangement of the specimens.

THE SYNOPTIC COLLECTION. The exhibition cases containing the myxomycetes, algae, fungi, lichens, hepatics, mosses, and ferns, and the earlier families of the flowering plants, were all rearranged and the specimens readjusted as a consequence of the change referred to above. Now the west hall has its full complement of exhibition cases.

THE MICROSCOPE EXHIBIT. The several stands of microscopes were removed from the west wing to the mezzanine landing between the first and second floors of the museum building. Fortunately the exhibit lent itself very well to the arrangement. The exhibits were readjusted or renewed as was necessary.

THE LOCAL FLORA. Specimens and figures representing several groups of the lower fungi were incorporated in their proper sequence in this exhibit. The cases formerly in the west wing were moved into the west hall.

THE PLANT PICTURE EXHIBIT. It was necessary to readjust this exhibit in order to make room for the frames moved from the west wing into the west hall.

THE FOSSIL PLANT MUSEUM. About eighty specimens were received for this department. They came mainly from the Arctic regions and from the West Indies. The specimens are available for both the public exhibits and the research collections. For particulars see the report of the Honorary Curator of Fossil Plants.

Herbaria

The additions to the herbarium came primarily from Canada, the United States, Mexico, Central America, the

West Indies, and northern South America. About 10,600 herbarium sheets, containing fully 24,000 specimens were incorporated with the permanent collections. Considerable readjustment of the specimens in the cases was necessary because of the unequal accumulation of specimens. Algae from continental and insular North America and from the Antarctic regions were incorporated. Hundreds of microscope slides, particularly of the Bahama algae were prepared and placed with the specimens. Fungi from North America, the West Indies and from Africa were added to permanent collections. The more important species were those from North America and South America. Lichens came almost wholly from southern Florida and the Bahamas. Hepatics added were mainly from eastern North America. Bryophytes representing a wide geographic range were added. The additions to the fern herbarium, like that of the flowering plants, were mainly from America. The most important were derived from Canada, the United States, Mexico, the West Indies, and northern South America. A few specimens were received for the Columbia University Herbarium. They were mounted and added to that collection.

The local herbarium was increased by special and selected specimens collected mostly by members of the Garden staff while on field excursions of the Torrey Botanical Club and on vacations. Some specimens were also secured through exchanges.

Investigations and Assistance

Dr. P. A. Rydberg, Curator, had charge of the herbarium of flowering plants. In addition to the usual curatorial work connected with the collections of mounted specimens, he sorted all the unmounted herbarium specimens of North America into systematic order, so as to make the specimens of any group easily available for study. He also continued taxonomic work on the families Fabaceae, Ambrosiaceae, and Carduaceae for North American Flora.

The manuscript of Ambrosiaceae was finished and was delivered to the editor. The manuscript of the tribe Senecioneae (except the genus *Senecio*) is essentially finished and is sufficient for another part of North American Flora. Work on the tribe Indigofereae of Fabaceae and on the following tribe Galegeae is advancing. Only a little work was accomplished on the flora of the Rocky Mountains; a "Key to the Rocky Mountain Flora" was published during the spring and one article in the series "Phytogeographical Notes on the Rocky Mountain Region" was printed during the summer.

Dr. Marshall A. Howe, Curator, remained in charge of the collections of algae and hepaticae in the herbarium and museums. Determination and entry into the herbarium of somewhat more than 2,000 field numbers of marine algae collected some years ago by Dr. Howe in the Bahama Islands has constituted the chief work of the year, and the results of this study have been summarized in a systematic treatment of the algae of the Bahamas contributed to Britton & Millspaugh's "Bahama Flora," now in press. Papers published during the year include "On Some Fossil and Recent Lithothamnieae of the Panama Canal Zone," "Tertiary Calcareous Algae from the Islands of St. Bartholomew, Antigua, and Anguilla," and "Dahlias and their Culture." Dr. Howe continued in charge of the Garden's dahlia border, has given three lectures in the Saturday afternoon courses, and has continued to act as an associate editor of the publications of the Torrey Botanical Club and as delegate from the Torrey Botanical Club to the Council of the New York Academy of Sciences.

Dr. Fred J. Seaver, Curator, continued in charge of the fungi, which have been installed in their new quarters on the second floor of the museum building. Research has been continued on the cup-fungi of North America and also on certain of the lower fungi causing leaf-spot diseases, both preparatory to monographs for North American Flora. A chapter on Bahama fungi has been written for

the "Bahama Flora," and work is under way on the Porto Rican fungi for a similar flora. A number of museum specimens have been installed; also several illustrations for the swinging frames. Local collecting has been continued and one week was spent at Ithaca, New York, collecting in cooperation with Cornell University and Syracuse University. About two hundred specimens were obtained. One lecture has been given in the regular Saturday course; also one lecture and one demonstration given before the class in gardening for convalescent soldiers. Work has been continued on destructive insects. One paper and several notes were published on this subject during the year. He represented the Garden during two days of the session of the meeting of the international potato pathologists on Long Island.

Mr. Percy Wilson, Associate Curator, has continued his studies of tropical American plants and the arrangement and distribution of specimens and has devoted considerable time to cooperation with the Director-in-Chief in the preparation of a flora of Cuba. His duties as docent have been greatly increased through numerous requests received both from public and private schools desiring special instruction for their pupils. He has also assisted in many of the Saturday afternoon lectures.

Dr. Francis W. Pennell, Associate Curator, gave attention mainly to his monographic studies of the Scrophulariaceae, and to the arrangement of specimens, completing revisions of this family for the local flora and for the southeastern United States, and commencing and carrying to partial completion like treatments for Colombia, for Panama, for Cuba, and for Ecuador. Also he has made further advance in his revision of these plants for the Central Rocky Mountain States. Papers, embodying the results of these studies, are appearing, or are soon to appear, in various journals. In addition to work upon the Scrophulariaceae, he has continued his "Notes on Plants of the Southern United States," and has published a synopsis of

the small but critical genus *Kneiffia* of the Onagraceae. Routine work has mainly consisted in completing the task of sorting into sets and distributing his and Dr. Rusby's Colombian collections of 1917–1918. An additional duty has been the oversight of the Field Excursions of the Torrey Botanical Club, and in connection with this, the answering of many questions, both in the herbarium and in the field, concerning the local flora.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, further developed the economic museum. (See his report.)

Mrs. N. L. Britton, Honorary Curator of Mosses, further developed the moss herbarium. (See her report.)

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, further developed the fossil plant museum. (See his report.)

The writer in addition to curatorial routine and miscellaneous duties, accomplished considerable writing for the *Journal* and for *Addisonia* and several articles have already appeared in those journals. He continued his studies, incidentally, on plants of the southeastern states, particularly those of Florida and neighboring regions.

He spent several weeks in exploration in Florida both in the spring and in the fall. During the spring he travelled several thousand miles in peninsular Florida and on the Florida Reef, chiefly in search of specimens of the genus *Harrisia*, primarily for elucidating our knowledge of that genus as it occurs on the North American mainland for interpolation of it in the forthcoming volume (vol. 2) of the Cactaceae. In the fall, accompanied by yourself and by Mrs. Britton, special and general problems were investigated, both on the peninsula and on the reef. The main results of both these excursions have been embodied in papers which will appear in future issues of the *Journal*.

Respectfully submitted,

JOHN K. SMALL,

Head Curator of the Museums and Herbarium

REPORT OF THE SUPERVISOR OF PUBLIC INSTRUCTION

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1919.

Among the various facilities for public instruction at the New York Botanical Garden, the following may be mentioned:

Collections of living and dried plants and plant products prominently exhibited and carefully labeled; natural woodlands, fields, and meadows, with all that they contain of beauty and interest; floral exhibitions at stated intervals; a system of docentry by means of which the collections may be visited every week-day under expert guidance; lectures and demonstrations adapted especially to the children in the public schools; garden lectures for those interested in special phases of botany and horticulture; and regular public lectures covering a wide range of botanical and horticultural subjects.

Instruction has been given free to the public during 1919 in the manner suggested above, as well as by extensive correspondence, personal interviews, etc.

Lectures

REGULAR PUBLIC LECTURES

Illustrated public lectures on botanical and horticultural subjects have been given in the museum building on Saturday afternoons from April to November, as outlined below. The attendance for the year has averaged 87 for each of the 31 lectures; the maximum attendance being 232 on September 20.

April 5. "The Advent of Spring, with Illustrations of Spring Flowers," by Dr. N. L. Britton.

April 12. "Scenic Features of North American Mountains," by Mr. Leroy Jeffers.

April 19. "The Place of Trees in Men's Affairs," by Mr. Carl Bannwart.

April 26. "Some Interesting Tropical Trees," by Dr. W. A. Murrill.

May 3. "Evergreens," by Mr. G. V. Nash.

May 10. "Plant Hybrids: How Produced: Their Uses," by Dr. A. B. Stout.

May 17. "The Future of American Forestry," by Prof. J. W. Toumey.

May 24. "The Recognition of Medicinal and Poisonous Properties in Unknown Plants," by Dr. H. H. Rusby.

May 31. "Floral and Scenic Features of the Panama Canal Zone," by Dr. M. A. Howe.

June 7. "The Botanical Garden at Buitenzorg, Java," by Dr. H. A. Gleason.

June 14. "Destructive Insects," by Dr. F. J. Seaver.

June 21. "Edible Wild Mushrooms," by Dr. W. A. Murrill.

June 28. "Some Books on Gardening," by Dr. J. H. Barnhart.

July 5. "Why and How to Spray Plants," by Dr. E. B. Southwick.

July 12. "Dwarf Fruit Trees for Suburban Homes," by Capt. F. A. Waugh.

July 19. "Rose Gardens," by Mr. G. V. Nash.

July 26. "Attractive Flowering Plants of New York State," by Dr. H. D. House.

August 2. "Floral and Scenic Features of the Island of Jamaica," by Dr. M. A. Howe.

August 9. "Through the Central Andes of Colombia," by Dr. F. W. Pennell.

August 16. "Botanical Features of Ceylon," by Dr. H. A. Gleason.

August 23. "Flowering Shrubs," by Mr. Arthur Herrington.

August 30. "The Proper Care of Shade Trees and Ornamental Plants," by Dr. Mel. T. Cook.

September 6. "Sugar and Cocoa: Their History and Production," by Dr. W. A. Murrill.

September 13. "A Naturalist's Rambles in Florida," by Dr. G. C. Fisher.

September 20. "Dahlias and Their Culture," by Dr. M. A. Howe.

September 27. "Peeps into Gardens," by Mr. Leonard Barron.

October 4. "Autumn Coloration," by Dr. A. B. Stout.

October 11. "The Digestion of Vegetable Foods," by Dr. W. J. Gies.

October 18. "Fall Planting and Winter Protection," by Mr. G. V. Nash.

October 25. "Conserving the Forests and Wild Life of New York State," by Mr. C. G. Abbott.

November 1. "The Tea Gardens of Ceylon and Japan," by Dr. H. A. Gleason.

Special Garden Lectures

The following lectures were given in the Central Display Greenhouse at Range 2 on Saturday afternoons at 3:15 o'clock, where living plants could be used to illustrate them. This method of presentation met with the instant approval of plant lovers.

November 15. "Cycads and Sago Palms," by Dr. N. L. Britton.

November 22. "Tropical Orchids," by Mr. G. V. Nash.

November 29. "Tropical Ferns and Their Relatives," by Dr. H. A. Gleason.

School Lectures and Demonstrations

A great many groups of children from the public schools of New York and nearby cities have been brought to the Garden by their teachers during the year and have received instruction in various ways, as illustrated by the lectures and demonstrations mentioned below.

On January 22, 300 pupils from Evander Childs High School visited the Garden to study living tropical plants, hardy trees, and plant products. They were in charge of Mr. Mann and some of his teachers, assisted by several members of the Garden staff. Mr. Hewitt gave an inter-

esting illustrated lecture on forestry in the large lecture hall in the museum building. The weather was mild and the work of the pupils very satisfactory.

The first lectures of the year for school children of the lower grades were given at the Garden as follows: April 23. "Plant Products," by Dr. H. H. Rusby; April 25. "Woody Plants," by Dr. F. J. Seaver; April 29. "The Cultivation of Plants," by Mr. G. V. Nash; and April 30. "Seedless Plants," by Dr. M. A. Howe. The lectures were followed by demonstrations from the living plants.

On June 17, over 300 biology pupils from the Morris High School, with Dr. Peabody and eight teachers, spent the forenoon at the Garden observing and making notes on tropical plants, trees, economic plants, and plant products, under the guidance and instruction of their own teachers and most of the Garden staff. Mr. C. G. Abbott, of the State Conservation Commission at Albany, gave an account of the various measures being taken by the Commission to preserve the wild life and other natural resources of the state. His lecture was illustrated with handsome colored lantern slides and was listened to with deep interest.

The June Biological Trip of the Evander Childs High School to the New York Botanical Garden took place on Thursday, June 19, under the leadership of Mr. Paul B. Mann and three of his teachers, assisted by eight members of the Garden staff. The pupils, 300 in number, assembled at the entrance to conservatory range 1 and were guided through the fifteen houses of this range in groups of 30. Trees and various kinds of herbaceous plants were then studied in the valley east of the conservatories, and plant products on the main floor of the museum building. Mr. George E. Hewitt gave an illustrated lecture on the subject of forestry, which was a fitting climax to a very successful and enjoyable occasion.

Seventy pupils and teachers from the Jewish School at 500 East 140th Street visited the Garden July 9, to study the economic collections in the museum building and living

plants in certain parts of the grounds, under the guidance and instruction of four members of the Garden staff.

Docentry

My personal attention was given to at least 10,000 persons during the year; while Mr. Wilson recorded about 1,500, Mr. Williams about 100, and Mr. Becker 800. The total probably reached 15,000. A few groups of visitors are mentioned below.

Members of the New Rochelle Garden Club visited the Garden on the afternoon of August 11 and were accompanied on their tour of inspection by Dr. and Mrs. Britton, Dr. Howe, and other members of the Staff. The dahlia border was first inspected, and Dr. Howe gave a brief talk on the selection and cultivation of dahlias, which was followed by questions and discussion. Then the tender and hardy water-lilies in the tanks at conservatory range 1 were examined and admired; after which the party visited the display borders of cannas, gladioli, and phlox, and the new rose garden. Mrs. Richards, the president, called a meeting of the club at the Mansion at 4 P. M., at which twenty members were present, most of whom remained to see the experiments of plant-breeding being conducted near the propagating houses by Dr. Stout.

About seventy students of the Columbia Summer School visited the Garden on the afternoon of August 8, under the leadership of Mr. L. W. Crawford, Jr., and were escorted through the grounds and buildings by Drs. Murrill, Howe, Barnhart, and Pennell, of the Garden staff.

The Garden was visited August 27 by some four hundred members and guests of the American Pharmaceutical Association, then in convention in New York. The visitors, divided into groups, were guided through the museum building by members of the Garden staff, after which they inspected the main conservatory range and drove through the grounds. The time was too brief for more than a cursory view of the collections, especially those in the

economic section, and many regrets were expressed that the fine materia medica collections could not be examined in detail, these being naturally of paramount interest to pharmacists.

Floral Exhibitions

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of flowers in the museum building on the dates given below. These were all well attended and aroused much interest in floriculture. The collections of irises, peonies, roses, dahlias, etc., on the grounds also attracted large crowds of people.

May 10, 11. Exhibition of Flowers.

June 7, 8. Exhibition of Roses and Peonies.

August 23, 24. Exhibition of Gladioli.

September 20, 21. Exhibition of Dahlias.

There was also an attractive floral exhibit in connection with the opening of the new central display greenhouse in Range 2 from November 8 to 10.

Plants Used in Design

An exhibition of plants from the New York Botanical Garden and art objects with plant motives selected from the galleries of the Metropolitan Museum of Art was held in Class-room B of the latter institution from March 15 to April 21, as described and illustrated in the April number of the *Journal*. This exhibition attracted large numbers of people and was highly praised. The following public lectures on related subjects were given at that time in a room adjoining:

April 7. "Spring Flowers," by Dr. N. L. Britton.

April 14. "The Use of Plant Forms in Ornament," by Dr. A. D. F. Hamlin.

April 21. "Collection and Preservation of Seaweed," by Dr. M. A. Howe.

Personal Investigations

In addition to the work of public instruction outlined above, I have cared for the collections of higher fungi,

edited *Mycologia*, attended meetings, given lectures, and conducted an extensive correspondence with scientists seeking advice and assistance.

This has left little time for mycological investigation. The exhibit at the Art Museum and the moving of the herbarium of fungi also consumed many weeks of my undivided attention. My vacation was devoted mainly to collecting in various parts of Virginia and Maryland. For a list of my publications during the year, see the *Journal* for February, 1920.

The popular illustrated articles on fungi in *Mycologia* have been continued with the aid of colored plates drawn by Miss Eaton, three species of polypores and three species of gill-fungi having been treated in this series during the year.

Attention has also been given to Cuban and Bahamian fungi; a revision of the pileate polypores; and a taxonomic study of the resupinate species of polypores. On November 8, I lectured at Yama Farms on the subject of "Edible and Poisonous Mushrooms" and began a study of the fungi of that region which may lead to important results.

Respectfully submitted,

W. A. MURRILL,

Supervisor of Public Instruction.

REPORT OF THE SUPERVISOR OF GARDENING INSTRUCTION

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: In accordance with an agreement between the Federal Board for Vocational Education, Division of Rehabilitation, and the New York Botanical Garden, pursuant to consultation between Dr. W. Gilman Thompson, President of the Garden and officers of the Federal Board, instruction in gardening was commenced in 1919 with the vocational training of disabled soldiers, sailors and marines pursuing lines of instruction as formulated by you, and outlined in the *Journal* of the New York Botanical Garden for March, 1919. Later civilian students

were admitted, taking the same courses of instruction. The course began with one student in practical training in the greenhouse and outdoor work on January 16, and with four others who entered in February and two entering on March 3, the first class was formed on March 3. During April the class reached a registration mark of 12, in May, 3 more entered, 7 came in June, 3 in July, 2 in August, 1 in September, 9 in October, 7 in November, and 6 in December making 50 students sent by the Federal Board for Vocational Education. Of this number 11 have left, 4 were transferred, 3 were sent to hospitals, 1 died, 1 was taken out of training by the board, and 3 left for unknown reasons.

Three civilian students have been registered, Mrs. M. L. Johnston of Kansas City, entered on April 14, Miss Tallulah Moore of McColl, S. C. on July 7, and Mr. Robert Galloway of Yonkers, N. Y., on October 1, 1919. Miss Moore studied garden methods and plant materials in order to take charge of the work on her home estate, and left on September 1, 1919. The total registration of students for the year was 53, and at the close of the year 40 were taking instruction.

Before March 3, 1919, only practical training under our gardeners was given. On this date seven men were formed into a class, and the instruction continued in the main as outlined in the *Journal* for March, 1919. For the rest of the winter quarter the practical work was given in the greenhouses, and included watering, mixing of soils, potting, propagation, top-dressing, pruning and care of plants, under supervision of Mr. H. W. Becker, Foreman Gardener; and outdoor spraying for oyster shell and other scales by Dr. E. B. Southwick and Mr. John Finley, Foreman Gardener. Two afternoons weekly were devoted to garden botany, mainly a study of conifers, under the supervision of Mr. George V. Nash, Head Gardener. A course in elementary botany was given three mornings weekly during this period by Dr. A. B. Stout, Director of the Laboratories. This included a study of seeds, seed-

lings, buds, stems, leaves, flowers and fruits. Special lectures were given each week by Dr. Britton and members of the scientific staff of the Garden, and special demonstrations were held each week, including moving of trees, preparation of leaf mould, and building of paths and roads.

For the spring quarter, commencing on April 14, with ten students registered, the greenhouse practice, in continuation of the previous work, was cut to one morning weekly. A course in vegetable gardening occupying two mornings weekly, was given by Mr. John Finley, Foreman Gardener, one area south of the Nursery being devoted to such crops as corn, potatoes, beans, cabbage, celery, kale, Brussels sprouts, pumpkins, and the like, while about 15 small individual gardens, adapted to backyard or kitchen gardens, were installed on the school garden area, devoted to radishes, onions, beets, Swiss chard, parsley, carrots, turnips, salsify, lettuce and spinach. Two mornings weekly were taken up with the theory and practice of flower gardening under my supervision, carried out chiefly in the flower beds near conservatory range 1, and in the special collections of iris, gladiolus, dahlias and herbaceous grounds. The seedlings and bedding plants were transplanted, chrysanthemums planted, and gladiolus bulbs and other collections installed.

Two afternoons were devoted to garden botany, given by Mr. George V. Nash, Head Gardener, and myself, treating the early flowering trees, shrubs, and herbaceous plants of our collections, studying the kinds, their adaptions and conditions favorable to growth. Dr. E. B. Southwick, Custodian of the Herbaceous Grounds, gave a course in garden zoology, taking up one afternoon a week, devoted to a study of insects and animals encountered in horticultural work. Mr. A. J. Corbett, Superintendent of Buildings and Grounds, gave a course in garden carpentry, including the use of tools, the making of handy equipment, rustic benches, and other things for garden uses.

For the summer quarter, commencing July 7, with 18

students registered, the vegetable gardening course was continued as before, Mr. Finley being assisted by Mr. Walter B. Balch. Late crops were sown, and transplanting and general care of gardens taken up. Practical work in flower gardening continued, and the garden botany course devoted to a study of summer-flowering subjects, particularly to the herbaceous flowers and variety studies in the special collections of iris, gladiolus and dahlia. One afternoon weekly was taken up by a course in plant physiology, given by Dr. A. B. Stout, Director of the Laboratories, consequent to the course in elementary botany given earlier in the year. Dr. Southwick continued his course in garden zoology during a part of this quarter.

During the autumn quarter, beginning October 6, the curriculum as arranged was altered to some extent. The students doing the practical work in sections, alternating between greenhouse practice at conservatory range 1 and practice in propagating bedding plants, sowing seeds and bulbs of floricultural subjects in the propagating houses, and fall work outdoors. This took up the mornings and Monday and Friday afternoons. Tuesday afternoons for this quarter were taken up by garden botany, a short course given by me with outlines and references, special attention being given to berry-bearing shrubs and trees, and the common broad-leaved evergreens. Beginning October 15, a course of ten lectures in plant chemistry was given on Wednesday afternoons by Dr. William J. Gies, Consulting Chemist to the Garden, treating of the elements of chemistry as applied to plants and their absorption, assimilation and elaboration of plant food. During this quarter the Illustrated Flora of the Northern States and Canada, by Dr. N. L. Britton and Judge Addison Brown, and the Cyclopaedia of American Horticulture, edited by Dr. L. H. Bailey, were installed in the reading room at the Lorillard Mansion, for use in reference work along with the periodicals relating to gardening. These reference works are now being used with increasing

Students

From Federal Board for Vocational Education:

	Entered	Duration	Left	Disability
Thomas T. Abbott, Paterson, N. J.....	Sept. 8	1 yr.		Valvular heart disease.
Carmelo Baiano, Dobbs Ferry, N. Y.	April 14	1 yr.		Gunshot wound in foot.
Isidor B. Blumborg, New York City...	Feb. 17	1 yr.	Sept. 15	Neurasthenia.
George S. Boyd, Peekskill, N. Y....	Feb. 24	1 yr.	Oct. 1	Tuberculosis arrested. Heart and stomach trouble.
Jeremiah Caples, Wallingford, Conn.	July 7	2 yrs.		Loss of one thumb joint. Ankylosis of joints.
Anthony Cerrone, Jr., Mt. Vernon, N. Y.	July 7	1 yr.		Chronic otitis media. Ear drum damaged.
Lawrence Curatol, Tuckahoe, N. Y...	Aug. 16	2 mos. extended		Lung trouble. Gassed.
Edward Downey, N. Y. City.....	May 1	1 yr.	Sept. 30	Lung trouble.
Henry O. Ewing, N. Y. City.....	April 29	1 yr.		Stomach trouble.
Michael Fabrizio, N. Y. City.....	May 12	1 yr.	May 20	Weak eyes.
Thomas Feltham, Newport, R. I.....	Feb. 17	1 yr.	Oct. 1	Injured knee.
Peter Flanagan, Brooklyn, N. Y....	Nov. 21	1 yr.		Tuberculosis.
Felix Galino, N. Y. City.....	Nov. 10	1 yr.		Gunshot wound. Loss right eye.
Raymond A. Ganyard, Cleveland, Ohio...	April 7	1 yr.	June 18	Amputated left leg.
Howard H. Hamm, New York City...	Dec. 9	1 yr.		Psychoneurosis. Gunshot wound left leg and finger.
Raymond C. Healy, N. Y. City.....	Oct. 28	1 yr.		Gassed.
Benny Greebler, New York City...	Oct. 23	1 yr.		Tuberculosis arrested.
Edward Hohmann, Brooklyn, N. Y....	Nov. 3	1 yr.		Gunshot wound mouth. Gassed. Dyspnœa.
Louis N. Jacobs, Florida.....	Oct. 21	1 yr.		Tuberculosis arrested.
Joseph B. Jones, N. Y. City.....	Nov. 17	6 mos.		Mastoiditis. Otitis media.
Emil Koch, N. Y. City.....	Dec. 1	1 yr.		Gunshot wound leg.

Students—Continued

	Entered	Duration	Left	Disability
Henry T. Lair, Lawrenceville, N. J.	June 24	1 yr.	June 24	Tuberculosis arrested.
Warren R. Landrum, Hattiesburg, Miss.	Mar. 3	1 yr.	Oct. 10	Tuberculosis arrested.
Stephen Latarwech, Ansonia, Conn.....	May 21	1 yr.		Tuberculosis arrested.
Joseph B. Laura, N. Y. City.....	Oct. 21	1 yr.		Eye and ear trouble.
Thomas Loftus, Norwich, N. Y....	April 17	1 yr.	June 6	Tuberculosis arrested.
Nathan Meyerowitz, N. Y. City.....	June 9	1 yr.		Acute rheumatism.
Walter J. Murray, N. Y. City.....	June 24	1 yr.		Tuberculosis quiescent. Fractured ribs.
Louis Nappi, N. Y. City.....	Mar. 3	1 yr.		Nervous trouble.
Hugh F. O'Neill, New Haven, Conn.	Mar. 11	1 yr.		Amputated left hand.
Umberto Palmeri, New York City...	Nov. 10	6 mos.		Tuberculosis arrested.
Frank Paris, Yonkers, N. Y.	Oct. 28	1 yr.		Gunshot wound.
Laurence Pauline, Port Chester, N. Y.	Oct. 20	1 yr.		Chronic bronchitis. Tachycardia, dyspnœa. Myocarditis.
James B. Reilly, N. Y. City.....	Dec. 1	1 yr.		Loss of hearing. Ruptured ear drums.
Antonio Sacchetti, Yonkers, N. Y.	Aug. 1	1 yr.		Gunshot wound left arm and side.
Thomas Sheehan, Brooklyn, N. Y....	Nov. 21	1 yr.		Partial paralysis of external and internal nerve of leg.
Thomas E. Sindler, Islip, N. Y.....	Feb. 3	1 yr.	May 16	Loss of hearing.
Walter F. Snyder, Wurtsboro, N. Y..	Oct. 20	1 yr.		Tuberculosis incipient and quiescent.
Philip Sobol, N. Y. City.....	June 11	1 yr.		Tuberculosis arrested.
William M. Steele, Yonkers, N. Y.	July 22	3 mos. extended		Stiff finger. Mental deficiency.
Henry C.Swentzel,Jr., N. Y. City.....	June 19	1 yr.	July 7	Compound fracture of hip.
John M. Tanikawa, Hilo, Hawaii.....	Oct. 30	1 yr.		Gassed.
John F. Toole, Clinton, Mass.....	June 2	1 yr.		Conjunctivitis. Gunshot wound left ear Defective vision.

Students—Continued

	Entered	Duration	Left	Disability
Max Ulrich, N. Y. City.....	Dec. 1	1 yr.		Tuberculosis arrested.
Sebastiano Vacchio, Brooklyn, N. Y. ..	June 2	1 yr.		Shrapnel wound left knee. Limited flexion.
William Wager, Staten Island, N.Y.	Dec. 1	6 mos.		Wound in head. Fractured skull.
Arthur Wagner, N. Y. City.....	Oct. 6, 1919	1 yr.		Operation for sinusitis and ethnoiditis.
William Weisinger, N. Y. City.....	Nov. 21	1 yr.		Gassed.
Michael Wozniak, Detroit, Mich.....	Jan. 16	1 yr.	Died. June 3	Tuberculosis arrested. Shell shock.
Warren J. Brunt, Philadelphia, Pa...	Dec. 9	1 yr.		Gunshot wound left side.

Civilians:

Mrs. M. L. Johnston, Kansas City, Mo., entered April 14, 1919.

Miss Tallulah Moore, McColl, S. C., entered July 7, left September 1, 1919.

Robert Galloway, Yonkers, N. Y., entered October 1, 1919.

frequency by the students. Three textbooks have been furnished to the students: Manual of Gardening, Bailey; Greenhouse Management, Taft; and Productive Vegetable Growing, Lloyd.

I was appointed Marshal of the Garden School on February 14. Mr. Walter B. Balch, a graduate of Cornell University took up his duties as instructor and has assisted with the vegetable gardening course, the conservatory and floricultural instruction, and with social and financial matters of the disabled service men. My appointment as Supervisor of Gardening Instruction took effect October 1. In addition to general supervision of the gardening instruction, I have spent much time in the interest of the social and financial welfare of the students, in cooperation with Messrs. Farwell, Higbee and Pyle, of the Federal Board for Vocational Education. The health of the dis-

abled service men has improved generally. Through the efforts of Dr. W. Gilman Thompson, President of the Garden, one of our students, Mr. Hugh F. O'Neill, was furnished with an artificial arm, furnished and fitted by Dr. Thompson's clinic at 5 Livingston Place, New York City.

Respectfully submitted,
KENNETH R. BOYNTON,
Supervisor of Gardening Instruction.

REPORT OF THE HEAD GARDENER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1919.

Systematic Plantations

HERBACEOUS GROUNDS. The herbaceous collections, including those at the nurseries, have comprised during the past year about 3,400 species and varieties; in the herbaceous grounds there are 130 beds, 26 east of the brook and 104 west. Dr. E. B. Southwick, Custodian of the Herbaceous Grounds, has been in charge of the work here, and also in the economic garden and morphologic garden.

FRUTICETUM. There are here 2,963 specimens. With the inclusion of those still at the nurseries, the hardy shrub collections represent 52 families, 143 genera, and 1,071 species and varieties; 196 show labels have been placed here during the year.

SALICETUM. The collections here are about as they were last year: 159 specimens, representing 2 genera and 39 species and varieties.

DECIDUOUS ARBORETUM. There are 1,120 specimens here. Including those still at the nurseries, the collection of deciduous trees contains 421 species and varieties, representing 31 families and 59 genera; 429 show labels have been placed here during the year.

PINETUM. This collection has now 1,718 specimens,

representative of 3 families, 20 genera, and 267 species and varieties. The yew collection was increased by the addition of 26 specimens taken from the beds at conservatory range 1. While this added no new forms, they extended considerably the size of the collection, making a large group to the north of the transverse path.

VITICETUM. Here 51 species and varieties are represented.

CONSERVATORIES. The tender collections have representatives of 207 families and about 9,400 species and varieties, including some still at the propagating houses.

Range 1. There are here 8,562 plants. Owing to repairs being made on houses 12 and 15 these at present contain no plants. The plants are distributed as follows: house 1, 268; house 2, 275; house 3, 463; house 4, 674; house 5, 1,810; house 6, 530; house 7, 822; house 8, 688; house 9, 146; house 10, 1,008; house 11, 437; house 13, 315; house 14, 1,126; 261 show labels have been placed here.

Range 2. The plants belonging here, and which had been temporarily crowded with those at range 1, were returned during the late summer and fall. The tree ferns and the larger specimens of the other ferns are in their old position, the westerly two houses of the transverse north range, the large cycads again occupying the easterly house. In the westerly low house are the temperate plants, in the next house the main collection of ferns, and in that next the orchids. The new orchid house given by the Messrs. Guggenheim is not yet ready for occupancy. The 5,038 plants here are distributed as follows: westerly tree fern house, 81; second tree fern house, 115; cycad house, 39; temperate plant house, 947; fern house, 1,060; north orchid house, 952; south orchid house, 1,310; central display house, 486; runway, 38; cellar, 10; 320 show labels have been placed here.

The central display house, given by Mr. Daniel Guggenheim and Mr. Murry Guggenheim, has proved of especial

interest and a great attraction to the public; it was formerly opened on November 8. A flower show was arranged in this house for that opening, the show continuing until the following Monday. This house has proved well adapted for the holding of flower shows, at least during the fall months, the flowers keeping well; one of the bush chrysanthemum plants was not removed until the middle of December, and some of the begonia plants exhibited were still in excellent condition at the end of that month, and apparently good for some time more. The contents of this house comprise plants formerly in houses 12, 13, and 14 of range 1, with the addition of a collection of about 30 species of acacias.

Propagating Houses and Nurseries. Here the classes of soldiers and sailors have the use of house 3 and part of house 4; the Director-of-the-Laboratories has part of house 4 and the two side benches in house 2. Exclusive of the plants used by the Director-of-the-laboratories for his special studies, there are here 6,147 plants. There have been received 856 packets of seeds, as follows: by gift, 67; by purchase, 463; by exchange, 296; collected, 30.

Labeling, Recording and Herbarium

The head gardener's assistant has had charge of this work. The services of a label boy have been available for only six weeks, with a consequent great reduction in the usual output. The head gardener's assistant has made the labels which were most urgently needed. The following labels have been prepared: deciduous arboretum, 429; fruticetum, 196; conservatory range 1, 261; conservatory range 2, 320; conservatory beds, 49; horticultural gardens, 120; rose garden, 126; dahlia collection, 254; total, 1,755; 35 family signs have also been prepared for the herbaceous grounds.

Accession numbers 47,074 to 47,781 have been recorded, making a total of 708 accessions.

The following plants have been received: by gift, 11,364

(including the large collection of tulips presented by John Scheepers, Inc.), valued at $2,668; by exchange, 265; by purchase, 316; by collection made by members of the staff and others, 383; derived from seeds from various sources, 345; total, 12,673. The herbarium of cultivated plants has been increased by 485 specimens.

In the collections will be found, including those native to the tract, approximately 241 families, 2,139 genera, and about 14,614 species and varieties.

Miscellaneous Collections

Among these are included the following, in which no important changes have been made: morphologic garden; economic garden; collections of desert plants placed during the summer in the court of conservatory range 1; conservatory lily pools; aquatic garden; rhododendron collections in the vicinity of the lakes, at conservatory range 1, and in front of the museum; rose bed east of conservatory range 1; flower gardens in the immediate vicinity of conservatory range 1, at the elevated approach, and the west border; American wood garden; iris garden; magnolia garden; American thorn garden; white pine plantation; red pine plantation; lilac and peony garden.

In the following collections changes have been made:

Rose Garden. This has been developed along the lines originally adopted of making it a collection of roses, and is being visited by an increased number of people each year. No new beds were opened during the year past, the number remaining at 104. During the past year there have been 511 kinds in the collection, represented by 5,424 plants; 126 show labels have been placed here.

Horticultural Garden. This has proved one of the most attractive features, and has been further developed during the past year. The construction of additional paths made necessary the elimination of certain beds and the opening of others to take their places. A total of 19 beds were maintained; of these 13 were devoted to gladioli,

of which there were 247 kinds, with a total of 21,000 plants. One bed contained garden phlox. In another was a collection of 55 kinds of plants with variegated and colored foliage, a collection not represented the previous year. The plantation of mallows was increased by the addition of more plants from the collection of hybrids produced by Dr. Stout, of the scientific staff.

The collection of cannas was considerably enlarged, many kinds being represented not shown before. Three beds were devoted to these plants, the two long ones bordering the main entrance on each side, and the large oval one. 41 kinds of cannas were shown, represented by 1,830 plants. This was a most attractive display, especially adapted to an entrance, as the striking masses of color persisted from early summer to the time of killing frosts. In the remaining bed was a display of century plants. 120 show labels were placed here during the summer.

Dahlia Collection. This collection was continued, with additions, the plants being assembled under the direction of Dr. M. A. Howe, of the scientific staff. This year there were 343 kinds and 616 plants. Many visited the collection during the late summer and fall, the attendance being even greater than last year, and it is one of the most popular exhibits of the Garden; 254 show labels were placed here during the summer.

Chrysanthemum Collection. A collection of garden chrysanthemums was placed in the west border, south of the depot plaza. There were 53 kinds and about 1,200 plants.

Collection of Late Tulips. In the seven beds in the court of conservatory range 1 a large collection of late tulips was planted in the fall. These were given to the Garden by John Scheepers, Inc., of 2 Stone St., New York City. The collection contains 9,343 bulbs of 117 varieties, divided as follows: Darwin, 52; Breeder, 35; Cottage, 27; Bizarre, 3. This is a valuable collection, and

contains some kinds not exhibited in this country before. Tulips of this class usually bloom from the middle to the end of May.

General Horticultural Operations

For the accomplishment of this work the following force has been available: monthly, 2 foreman gardeners, 22 to 27 gardeners, and 4 drivers; laborers, 12 to 14. The details of the outside work have been under the direction of Foreman Gardener John Finley, to whom were assigned about 8 gardeners, the drivers, and laborers. H. W. Becker, Foreman Gardener, has had charge of the work in the conservatories and propagating houses; to him was assigned the remainder of the force.

The following new work was accomplished:

In the Spring, the rearrangement of the conservatory beds, made necessary by the removal of large specimens to other parts of the grounds, mainly yews for the enlargement of that collection. The removal of a large specimen of *Taxus cuspidata densa* from the yew collection to the circle in front of conservatory range 1. The planting of 23 conifers around the comfort station at the Mansion, as follows: 3 white spruce, 1 blue spruce, and 4 Douglas spruce from the collection at the Long Bridge; 3 Austrian pines from the west border; and 12 Douglas spruce from the nurseries of Hicks & Son. 3 sugar maples were transferred from the west border to the 200th St. entrance. In the horticultural gardens the planting of 21,000 gladiolus corms, 1,830 canna plants, and the collection of plants with variegated and colored foliage; the planting of the War Memorial Grove, and of the group of *Abies concolor*.

In the Fall in the horticultural gardens, the removal, labeling and storing of the large collections of gladioli and cannas. The removal, labeling and storing of the dahlia collection. The planting in the rose garden of over 300 plants, some for replacements, others of kinds not formerly in the collection; and the protection of the whole collection by hilling up and by top-dressing. The

planting of the large collection of late tulips in the beds of the court at conservatory range 1.

Investigations and Lectures

My studies in horticultural botany have been continued, and the preparation of the list of the hardy woody plants in the Garden has been carried on and is now nearing completion; my studies on the orchids have also been prosecuted.

I have acted as one of the editors of *Addisonia*, continuing my supervision of the preparation of drawings for that periodical. In the regular public courses of the Garden I have given three of the lectures, and one in the special course arranged for delivery at the new central display greenhouse.

Respectfully submitted,

GEORGE V. NASH,
Head Gardener.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1919.

General Matters

The routine duties connected with my position have been performed as in previous years. In addition I have, during the year, supervised courses in elementary plant physiology and in general botany given to students of the school in gardening for convalescent soldiers and sailors. This latter work has taken one day each week during nine months of the year. In general, the laboratories, experimental greenhouse, and breeding plots have been maintained as in the previous year. Several matters pertaining to repair, additional equipment, and normal expansion are, however, awaiting attention.

Personal Investigations

Research has been continuously prosecuted throughout the year as vigorously as time and facilities have permitted. The experimental work has been directed chiefly to studies of fertility and sterility in plants. Phenomena of the so-called correlative sterility have been studied in several species of *Lilium* and *Hemerocallis.* Studies of variation and heredity in respect to the morphological development of flowering parts (intersexualism) in *Plantago lanceolata* have been continued. Pedigreed cultures of *Lythrum Salicaria*, grown from seed obtained by self-fertilization, have yielded important results bearing on intersexualism and on compatibility in fertilization in this interesting tri-morphic species. In this work with *Lythrum* I was very materially assisted by Mr. H. E. Thomas to whom you granted a scholarship for one month during the summer.

Study of self-incompatibility and self-compatibility has been continued in the radish, in various types of pe-tsai and in *Verbascum phoeniceum.* Fertility and sterility are also being studied in various variegated sorts of *Pelargonium* and in a variegated sport of the strawberry. Observations on the flowering habits of bulb plants are being continued especially with reference to the after effects of forcing.

The studies noted above have been intensive rather than extensive. Rather few plants have been grown but these have been carefully and thoroughly studied. The difference in blooming dates of the various species and the growing of certain cultures in the greenhouse have distributed the work of observation and experimental manipulation well over the year.

The numerous bud-sport varieties previously obtained in *Coleus* have been maintained in culture and several new types of bud-sports have appeared. The study of seed progenies in these bud-sports, somewhat delayed by war-time conditions, has again been taken up. Numerous strains have now been rather thoroughly tested as to

vegetative constancy and the time now seems opportune to prosecute vigorously the behavior in seed reproduction. In various lines of experimental work now in progress and especially in the study of seed progenies in *Coleus* and of incompatibility in pe-tsai I am now being greatly helped by the voluntary assistance of Mrs. M. J. Fox.

The studies with *Cichorium Intybus* have been brought to a conclusion and the new results with this species are now soon to be published, together with various other data on self-compatibility. No further work was done during the year with *Phlox subulata* and with species of *Hibiscus*. I should be pleased to again take up experimental and field studies of these.

During the autumn I spent several days at the State Experimental Station at Geneva, N. Y., in making observations bearing on the fertility of the grape. A report of the trip, with recommendations for cooperation with the Department of Horticulture at the Geneva Station in certain very fundamental studies of the grape, has already been submitted to you. Details of the plans for the growing of grapes at our Garden for the purpose of general public interest as well as for scientific study await your further consideration.

The phenomena of sterility and fertility in the cultivated potato have long been of special interest. There are undoubtedly two or more types of sterility operating. Preliminary experiments have been begun to determine this point most conclusively. Various workers in the Bureau of Plant Industry and in several State Agricultural Experiment Stations have greatly assisted me by supplying tubers of various fruitless and fruitful varieties and also seeds of the latter. I am planning to make a comparative and intensive study of these during the coming summer on the basis of the experience already gained with other plants.

Several papers dealing with the results of my personal research have appeared during the year.

Students and Scholars

STUDENTS

The students here named were formally registered for research in connection with studies for degrees.

Findlay, Hugh.	Genetics. Fertility and sterility in *Abutilon*.
Gershoy, Alexander.	Taxonomy.
Stevenson, Mrs. F.	Variegation in *Tussilago*.
Tai, Tang-len.	Genetics.
Thomas, Harvey Earl.	Pathology and genetics.

SCHOLARS

Thomas, Harvey Earl.	Sterility and fertility in *Lythrum Salicaria*.

Respectfully submitted,

A. B. STOUT,
Director of the Laboratories.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1919.

Regulating and Grading

We removed 1,200 yards of earth for the new coal bunker for power house No. 1, which was used to fill in the swale on the northern side of the horticultural garden. The southern end of the old lane nearby was graded down to the roadway. The bank between the path and road near the white pine plantation was graded and sodded for a distance of 15 x 550 feet. About one acre of ground was graded for the war memorial plantation of Douglas spruce. Both sides of the central display house of conservatory range 2 were graded. A bank 125 feet long and 15 feet wide west of conservatory range 2 was graded and sodded. The western bank of the rose garden was graded for a

distance of 15 x 140 feet. About 300 yards of earth were taken from conservatory range 2 and used to fill in the new road at the rose garden. The earth of two sections in the display house at conservatory range 2 were taken out and replaced with topsoil so that we might put the plants in the ground. This topsoil was taken from the two new paths under construction, one on the eastern side of power house 2 and the other near the cherry garden shelter.

About 600 yards of fill were hauled into the Garden by outside contractors. It was carted in at the expense of contractors who were seeking a convenient place to dispose of it. About 400 yards were placed on the new road at the rose garden and the remainder was used for the lane near the horticultural garden.

We blasted about 1,500 yards of stone in the two quarries. This stone and the balance of that which was blasted last year were used for paths at the horticultural and rose gardens and to build the coal bunker at power house 1. Nearly 250 cubic yards of stone were used to build this coal bunker. The stone taken from the quarry near the museum building was used to build paths south of the horticultural garden.

Drainage

To drain the coal bin at power house 1, we used 50 feet of 4-inch drain pipe. Two catch basins and 120 feet of 3-inch drain pipe were used to drain the mallow garden.

Roads and Paths

The plaza at the western entrance of conservatory range 2 was enlarged from 40 x 40 feet to 50 x 75 feet. We cut out soil east of power house 2 for a path 10 feet wide and about 800 feet long and also for a path 10 feet wide and 100 feet long near the cherry garden shelter, and used it in forming planting areas in the central display greenhouse. On the western side of the rose garden a 10-foot path, 510 feet long, with a branch 10 feet wide and 60 feet

long was lined with stone and partly paved. Paths were built on both sides of the road near the white pine plantation. A path on the western side 10 feet wide and 560 feet long was lined and 450 feet of it was paved and is ready now for the top finish. On the eastern side a 10-foot path 735 feet long was lined and 250 feet have been paved. A 10-foot path 210 feet long was built complete on the southern side of the war memorial grove.

Buildings

Repairs were made to the doors and windows of the museum building. The fountain basin in front of the museum building was cemented and tarred. The inside and outside of houses 5 and 15 at conservatory range 1 were painted and sash bars were replaced wherever necessary. About 700 lights of glass were used to replace that which had been broken at conservatory range 1.

Two concrete benches 60 feet long and 3 feet wide were built in house 15 of conservatory range 1. At power house 1 the masons built a coal bin 15 feet deep, 34 feet wide and 58 feet long to hold about 700 tons of coal. The five boilers at power house 1 were relined with fire brick.

In the new orchid house at conservatory range 2, 477 line feet of concrete benches were built; in the central display house two concrete tanks and two rubblestone tanks, with brook connections, were installed, and paths were built from both entrances to the lecture platform. One boiler at power house 2 was relined with fire brick and the floor of the new coal bin was concreted. The masons have completed the masonry work on the cherry garden shelter.

The steam engineers made whatever repairs were necessary at both power houses, conservatories and museum building.

The painter replaced about 120 lights of glass at the propagating houses and the carpenter replaced 16 sash bars. The carpenter made forms which were used for all concrete work around the grounds.

Grounds

For the use of the gardening school, the carpenter built a wire fence 6 feet high, enclosing an area 95 feet wide and 125 feet long at the school garden. He also put up a wire fence 6 feet high, surrounding a plot 75 feet wide, and 200 feet long south of the nursery.

By running the gasoline engine for two weeks, sufficient wood was cut to supply the propagating houses with fuel for four months and the mansion for two months. We have continued the uprooting of the poison ivy throughout the Garden. About 75 tons of hay were cut during the summer.

From June to September we had two city officers in civilian clothes on Saturdays, Sundays and holidays. With our two regular keepers and twelve additional guards selected from among the gardeners and laborers, the grounds and plantations have been protected. One city officer was detailed to the Garden every day during the year. On Saturdays and Sundays during the summer months the number of visitors averaged about 45,000. Nearly 4,000 children visited the picnic grounds every week from May to September. On Saturday, June 21, we had four parties, one of them with 3,000 children.

Respectfully submitted,

ARTHUR J. CORBETT,

Superintendent of Buildings and Grounds.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1919.

The customary amount of my time has been devoted to the bibliographic assistance of users of the library, and the unusually small amount of publication during the year has permitted considerable research and writing of manuscripts.

At the beginning of the year the prospect of progress in the publication of *North American Flora* looked unusually

bright, but conditions in the printing trade have continued to delay this publication. Vol. 24, part 1, was issued in April, and a second part of the same volume was to have appeared in December, but was delayed until a few days after the close of the year. The continuation of vol. 7 has been partially in type for months, but "copy" for it sent to the printers in April has not yet been set up. More material for *North American Flora* is on hand than ever before, and with improved trade conditions progress should be made rapidly.

The fourth volume of *Addisonia* has appeared, in four parts, during the year. Increasing cost of production has resulted in a crisis in the history of this journal, which demands serious consideration of the future policy concerning it. Either it must be issued at longer intervals or larger endowment will be required.

There have been few noteworthy additions to the library during the past year. The purchase of a copy of the atlas of Brackenridge's work on the ferns of the United States Exploring Expedition resulted in the preparation of an account, for the June number of the *Journal*, of Brackenridge and his book. A copy of Piso's work on the natural history of the Indies (1658), presented by Mrs. Henry O. Taylor, was of particular interest because of the autograph signature of the author on the engraved title-page (see *Journal* for April, page 93). Many current publications relating to horticulture, a field hitherto poorly represented in our library, were purchased during the summer, and are listed under "library accessions" in the September *Journal.*

Opportunities for the purchase of desirable books appear to be increasing, and the library can be developed rapidly whenever sufficient funds become available for the purpose. It seems unnecessary to emphasize the desirability of such development.

Respectfully submitted,
JOHN HENDLEY BARNHART,
Bibliographer.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1919.

Owing to the low temperature in the library it was found necessary to omit the customary census of the books. From the records, however, the following statistics can be given: books purchased, 147; bound, 323; acquired by gift, 71, and received by exchange or on deposit, 32, making a total of 573. From these should be deducted 107 books which were rebound and 11 permanently recalled by Columbia, showing a net gain of 455 over the census of a year ago. The total number of bound volumes in the library should therefore approximate 29,692.

As will be noted, a beginning has been made upon rebinding the older books of the collection. It is hoped that this work may be continued, also that more funds may be available for keeping the current periodicals bound up to date.

The principal accessions have been listed as usual in the *Journal.* The largest purchase of books was that of 125 works on agriculture, horticulture and landscape architecture, thus strengthening a part of the collection which was notably weak. Their shelving, however, has greatly crowded the stacks in the Bibliographer's room and additional space is again needed. In addition to the books just referred to, 312 pamphlets on similar subjects have been purchased and catalogued.

There have been added to the catalogue 1,573 typewritten and written cards, in addition to the printed ones issued by the Torrey Botanical Club. Owing to the resignation of the library assistant on November 15 this important work was necessarily stopped. It is hoped that another assistant may soon be appointed in order that this as well as other branches of the library work may not be curtailed. In spite of the weeding-out process which has been carried on in the general card catalogue many of the

drawers are still crowded, and it is highly desirable that another case be provided in the not far-distant future.

The current German periodicals subscribed to for 1918–19 through a Dutch firm have continued to arrive from time to time. It has been decided to renew the subscriptions for 1920 through our former New York agent. A list of lacunae in the sets for 1916 and 1917 has been sent with the order. Owing to a fire in Leipzig which destroyed a ware house in which many of these periodicals were stored during the war, it will be necessary to have the missing parts reprinted. A long period may therefore elapse before the volumes are completed.

The following additions and corrections should be made to the periodical list as appended to the report of the Librarian for 1916 (*Bulletin* 9: 342–363; 449, 450 and 10: 43).

Omit § before the following:

Annales Mycologici.
*Archiv der Pharmazie.
Brussels. Jardin Botanique de l'État, *Bulletin.*
†Deutsche Botanische Gesellschaft, *Berichte.*
Frankfort on Main. Senckenbergische Naturforschende Gesellschaft, *Berichte.*
‡Hedwigia.
*Jahresbericht der Vereinigung der Vertreter der Angewandten Botanik.
*La Cellule.

Omit the following:

Boletin des Bosques, Pesca i Caza.
La Naturaleze.
Practical Druggist.
Tree Talk.

Change the following:

American Museum of Natural History, *Journal* to *Natural History.*
Illinois State Laboratory of Natural History, *Bulletin* to Illinois State Natural History Survey, *Bulletin.*
Ottawa Naturalist to Canadian Field Naturalist.

Add the following:

*Arnold Arboretum, Jamaica Plain, Mass. *Journal.*
*Illinois. Academy of Sciences, Springfield, Ill. *Transactions.*
*Journal of Indian Botany, Madras, India.
*New York. Conservation Commission, Albany, N. Y. *The Conservationist.*
São Paulo. Museu Paulista, São Paulo, Brazil *Revista.*

Sociedad de Ciencias Naturales del Instituto de la Salle, Bogota, Colombia
Boletin.

Respectfully submitted,

SARAH H. HARLOW,
Librarian.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor of submitting the following report on the economic collections for the year 1919.

All specimens in the economic museum are systematically arranged in the cases, and a complete list of them has been written, the last pages of which are now being typed.

This work has occupied my entire spare time during the past year. It has been found much more extensive than was anticipated, owing to the fact that many omissions were discovered, the missing articles being of such importance that it was deemed undesirable to print a catalogue in which they were not enumerated. To secure these specimens has required the expenditure of much time and labor. Many have been donated in response to requests and many others secured through purchase by myself. Others have been specially collected for us by friends and a much larger number by myself. Of the latter, many were grown in my garden for this purpose. The total number of such specimens amounts to several hundred.

Besides these actual additions to our collections, the cases have been enriched by the installation of several hundred specimens which had been in storage, awaiting the necessary supply of containers.

As a result of these changes, nearly all of the two large lots of jars supplied me during the year have been filled and we are already in urgent need of a farther supply, especially of the smaller sizes and of some extra large ones. Many hundreds of base-blocks will also be required to complete the mounting of the jars.

Another result of the year's growth has been that of

crowding our cases beyond desirable limit, some of them to their utmost capacity, so that new ones are needed at once. I recommend that these be supplied by the installation of intermediate cases about the pillars on the eastern half of the main floor, to correspond with those already so placed in the western half. This increased room is specially desired for the elaboration of our representation of the poisonous plants of this region. This I think should be made a strong feature of our museum, and I have plans, the execution of which will require an entire additional unit of cases.

An equally urgent requirement is that of printed labels. Practically all of the additions of the past two years, besides many others, are without labels, other than the written memoranda placed in the jars for identification purposes. I estimate that more than two thousand labels now require printing, which number will rapidly increase.

It is to be hoped that arrangements can be made in the early future for some extensive collecting for this museum. We have very few of the specimens peculiar to Alaska and the adjacent region and there is a long list of desiderata of articles used by the aborigines of the Rocky Mountain region. Many edible products peculiar to the southern Alleghanies are also much needed. While many of these articles may be obtained by gift or exchange, experience has shown that the only efficient and reliable method is that of carefully arranged collecting expeditions by our own people.

The aggregate operations above recorded have greatly advanced the preparation of our Guide Book toward the stage of printing, although considerable work remains to be done upon the manuscript, in the way of verifying or correcting botanical names, and adding of items of information. The entire series requires numbering. The articles in the western half of the building were numbered last year, but the additions have been so very numerous that it seems desirable to renumber them as nearly as possible at the time that the printing is begun.

I may say in conclusion that arrangements for the printing of the Guide Book may be made in the early future, since I am in position to complete the above details immediately.

Respectfully submitted,

H. H. RUSBY,

Honorary Curator of the Economic Collections.

REPORT OF THE HONORARY CURATOR OF MOSSES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: In continuation of our West Indian studies two small collections have been purchased during the past year: one of Bahama mosses from Mr. Brace and another of Virgin Island mosses from W. C. Fishlock. About 650 other specimens have been received in exchange and 3,685 have been distributed from the duplicates of the Mitten Herbarium. Of these 950 have gone back to England to Mr. Dixon and the rest to various correspondents and institutions here and abroad. Among the collections sent to be determined by the United States National Museum, 73 mosses from Ecuador collected by Dr. J. N. Rose have been named by Mr. R. S. Williams, who has also determined a set of Peruvian and Trinidad mosses sent by H. N. Dixon.

The Geological Survey of Canada has sent us a complete set of the mosses from the Canadian Arctic Survey, including 137 numbers which have also been studied and reported upon by Mr. Williams. From Professor Brandegee we have received a set of Mexican mosses collected by Purpus, and from Miss Eastwood two sets of Hawaiian mosses, yet to be studied. Brother Leon has continued to send us his Cuban collections and a named set ready for mounting has been returned to him. A beginning has been made on the preliminary list of the mosses of Cuba. Dr. Andrews has shared his Iceland collections with us. We have continued our exchanges with the members of the Sullivant Moss Society, of which I have served as Presi-

dent for two years, and Mr. Kaiser, the Curator of the moss-herbarium, has assisted in answering the questions that have been referred to us for decision.

Acting as Secretary for the Stokes' Fund and the Wild Flower Preservation Society I have answered letters, distributed literature and arranged for the cooperation of various Garden Clubs and other associations, including the Boy Scouts, Torrey Botanical Club, schools, etc. The Audubon Societies also are cooperating, in order to secure native fruits for the birds. Owing to disturbed war conditions and the added cost of all color work, no illustrations of our native wild flowers needing protection have been printed, but four new ones are ready to be printed.

During the year a general supervision of the lantern slide collection was entrusted to me and 196 colored and 207 uncolored slides were added to the collection, including Dr. Pennell's Colombian and Dr. Rose's Ecuador slides, as well as Mr. Parson's slides of the school garden work and the photographs of the soldier students at work. Colored records were also made of some of the exceptionally fine dahlias from the west border, and a small set of some of our rarest native orchids were also added. Several applications for the loan of slides have been received but so far no provision has been made for this purpose.

Respectfully submitted,

ELIZABETH G. BRITTON,

Honorary Curator of Mosses.

REPORT OF THE HONORARY CURATOR OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows upon paleobotanical activities in connection with the Garden during the year 1919:

The work of arranging and installing selected specimens of fossil plants in the stratigraphic and biologic display series at the American Museum of Natural History, mentioned in my previous report, was continued during

the early part of the year, from time to time, and was completed in July. Several gaps in the biologic series were filled by exchange of specimens with the Garden, through which the Garden acquired a valuable lot of paleobotanical material from the collections made by the Peary Expedition in Greenland in 1891–1892.

Study of the fossil plant remains collected in Porto Rico by the joint natural history survey of the New York Academy of Sciences and the American Museum of Natural History was continued and drawings were made of specimens to be described.

Preliminary studies were begun of two interesting collections of fossil plants from Cuba,—the first recorded collections of the kind from that island, as far as I am aware—transmitted as a gift to the Garden by Brother Léon from Matanzas.

On November 28 I delivered a lecture before the Buffalo Society of Natural Sciences, as a part of their public lecture course for 1919–1920, on "Plants Concerned in the Formation of Coal." On December 2 I left for Washington to resume work in connection with the United States Geological Survey on the fossil flora of Alaska, which was interrupted during the past two years by the exigencies of the war.

Respectfully submitted,

ARTHUR HOLLICK,

Honorary Curator of the Collections of Fossil Plants.

ACCESSIONS TO PALEOBOTANICAL COLLECTIONS, 1919

The total accessions to the paleobotanical collections during the year include 84 specimens and approximately 40 species.

28 specimens from Greenland, by exchange with the American Museum of Natural History (21 Cretaceous, including 12 species; 7 Tertiary, including 9 species).

42 specimens from Cuba, by gift from Brother Léon (all Tertiary, including about 15 species).

13 specimens from Blacksburg, Va., by gift from Dr. W. A. Murrill (all Sub-carboniferous, one species).

1 specimen from Forsyth, Me., by gift from Freeman F. Burr (one species, probably Silurian).

SCHEDULE OF EXPENDITURES DURING THE YEAR 1919

1. CITY MAINTENANCE ACCOUNT

Allowance			$100,000.00
Expended			
Salaries	$63,462.17		
Labor	4,664.02		
Total Personal Service		$ 68,126.19	
Fuel	$21,902.40		
Forage	1,148.46		
Supplies	1,037.46		
Equipment	621.53		
Materials	5,190.74		
Repairs	1,552.57		
Shoeing Horses	218.75		
Gas Service	201.90		
Total Sundry Expenses		$ 31,873.81	
Total Expended			$100,000.00

2. SPECIAL GARDEN ACCOUNTS

Exploration Fund

Balance from 1918	$ 24.05		
Contributions	350.00		
Total		$ 374.05	
Expended		362.13	
Balance		$ 11.92	

Museum and Herbarium Fund

Balance from 1918	$ 26.08		
Contributions	400.00		
Total		$ 426.08	
Expended		417.46	
Balance		$ 8.62	

Plant Fund

Balance from 1918	$ 502.35		
Contributions to War Memorial Plantation	20.00		
Sale of Hay	540.00		
Sale of Plants	13.00		
Total		$ 1,075.35	
Expended		1,064.96	
Balance		$ 10.39	

Special Book Fund

Balance from 1918	*$ 78.86*	
Contributions	810.00	
Sale of Pamphlets	1.00	
Total		$ 889.86
Expended		387.34
Balance		*$ 502.52*

Rose Garden and Garden Extension Fund

Balance from 1918		*$ 13.85*
Transferred to Grounds Improvement Fund		13.85

Garden School Fund

Balance from 1918	*$ 3,263.12*	
Sale of magnifying glass	0.50	
Total		$ 3,263.62
Transferred to Convalescent Soldiers' Gardening Fund		3,263.62

Guggenheim Greenhouse Fund

Balance from 1918	*$ 53,217.15*	
Appropriated, balance of interest and profits	3,203.44	
	$ 56,420.59	
Less-transferred to Income Guggenheim Greenhouse Fund	958.29	
Total		$ 55,462.30
Expended, contracts	$ 51,076.50	
Salaries and Labor	2,066.00	
Miscellaneous	2,305.25	
Total		$ 55,447.75
Balance		*$ 14.55*

School Garden Summerhouse Fund

Balance from 1918		*$ 94.50*
Transferred to Grounds Improvement Fund		94.50

Emergency Fund

Balance from 1918		*$ 17.09*
Expended		17.09

Grounds Improvement Fund

Contributions	$ 4,930.00	
Transferred from Rose Garden and Garden Extension Fund	13.85	
Transferred from School Garden Summerhouse Fund	94.50	
Total		$ 5,038.35

Expended, Labor	$ 4,623.39	
Miscellaneous	219.90	
Total		$ 4,843.29
Balance		*$ 195.06*

CONVALESCENT SOLDIERS' GARDENING FUND

Contributions	$ 1,900.00	
Federal Board for Vocational Education, Fees	1,267.50	
Garden School, Fees	157.50	
	$ 3,325.00	
Transferred from Garden School Fund	$ 3,263.62	
Total		$ 6,588.62
Expended, Salaries	$ 1,851.67	
Miscellaneous	2,464.74	
Total		$ 4,316.41
Balance		*$ 2,272.21*

CHERRY GARDEN SHELTER FUND

Contributions		$ 2,000.00
Expended, Mason work	$ 800.00	
Labor	261.00	
Miscellaneous	442.01	
Total		$ 1,503.01
Balance		*$ 496.99*

RESERVE FUND

Appropriated against accumulated Life Membership Fees	$ 22,000.00	
Appropriation against accumulated Fellowship Members' Fees	8,000.00	
Additional Appropriation	3,730.00	
Total		$ 33,730.00
Expended, Salaries	$ 27,143.66	
Labor	1,271.84	
Miscellaneous	5,306.24	
Total		$ 33,721.74
Balance		*$ 8.26*

3. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balance*
Income of Science and Education Fund			
Publications	$	43.02	
Herbarium		393.33	
Lectures		751.22	
Laboratories		311.45	
Museums		1,084.05	

Photography		78.65	
Exploration		320.15	
Total	$ 4,000.00	$ 2,981.87	$ 1,018.13
Income of Darius O. Mills Fund			
Books and Binding		$ 541.28	
Investigations at other Institutions		93.58	
Scientific Supplies		1,064.71	
Total	$ 2,000.00	$ 1,699.57	$ 300.43
Accumulated Income of Henry Iden Fund			
Books	$ 500.00		$ 500.00
Income of William R. Sands Fund			
From income	$ 400.00		
From Horticultural Society of New York.	161.50		
Horticultural Prizes	$ 561.50	$ 553.00	$ 8.50
Accumulated Income of Olivia E. and Caroline Phelps Stokes Fund			
For the Preservation of Native Plants	$ 150.00		$ 150.00
Accumulated Income of Students' Research Fund			
Aid for Students' Research	$ 500.00	$ 150.00	$ 350.00
Income of David Lydig Fund			
Publications	$ 4,000.00	$ 3,970.18	$ 29.82
Accumulated Income of Addison Brown Fund			
For Preparation, Publication and Distribution of Addisonia.			
Salary of Artist		$ 375.00	
Printing		3,213.19	
Miscellaneous		97.71	
	$ 4,000.00	$ 3,685.90	$ 314.10
Income of John Innes Kane Fund			
Plants for Grounds and Greenhouses	$ 500.00	$ 324.56	$ 175.44
Income of Maria DeWitt Jesup Fund			
For Increase of the Collections			
Books		$ 171.78	
Specimens		407.29	
	$ 1,000.00	$ 579.07	$ 420.93
Accumulated Income of Charles Budd Robinson Fund			
For Aiding Exploration	$ 60.00		$ 60.00
Income of Guggenheim Greenhouse Fund			
Salaries		$ 165.00	
Mason Work		300.00	
Labor		159.00	
Miscellaneous		334.29	
	$ 958.29	$ 958.29	

4. GENERAL INCOME ACCOUNT

Insurance			
Glass in Conservatories		$ 185.63	
Boilers and Elevators		137.46	
Museum Specimens and Books		403.29	
Horses and Wagons		11.00	
	$ 740.00	$ 737.38	$ 2.62
Supplies (including Circulars for Members)	$ 1,025.00	$ 1,018.72	$ 6.28
Contingent Fund			
Miscellaneous	$ 1,515.00	$ 1,513.98	$ 1.02
Entertainment of Guests			
Refreshments		$ 174.00	
Hire of Touring Cars		80.75	
Printing		161.75	
Miscellaneous		15.00	
	$ 500.00	$ 431.50	$ 68.50
Assistance for Treasurer			
Services Rendered	$ 480.00	$ 480.00	
Salaries			
Individual Accounts		$ 11,851.67	
Museum Aides		1,180.00	
Gardeners		2,926.25	
Carpenter		180.00	
Drivers		970.00	
Janitors		1,360.00	
Miscellaneous		103.34	
	$18,575.00	$ 18,571.26	$ 3.74
Labor			
Weekly Payrolls		$ 2,105.00	
Guard Duty		938.80	
Miscellaneous Overtime		520.12	
	$ 3,570.00	$ 3,563.92	$ 6.08
Totals—General Income Account	$26,405.00	$ 26,316.76	$ 88.24

5. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts	$102,081.18
Special Income Accounts	14,902.44
General Income Account	26,316.76
Total	$143,300.38

6. BOARD ROOM FUND

January 1, 1919. Balance—Cash		$	54.32
Gross Receipts—January to December	$ 176.65		
Less—Credited to Garden Funds	4.85		
Total Net Receipts	$ 171.80	$	171.80
		$	226.12

Disbursements				
Supplies		$ 116.27		
Contingencies		5.67		
		$ 121.94	$ 121.94	
December 31, 1919.	*Balance—Cash*		$ *104.18*	$ *104.18*

Respectfully submitted,
WALTER S. GROESBECK,
Bookkeeper.

E. and O. E.

NEW YORK, January 12, 1920.

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

(*Received and ordered printed January 12, 1920*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The Scientific Directors have held their regular meetings through the year and have advised with the Director on many matters which are presented in detail in his report. In spite of the difficulties from high prices and the scarcity of labor, the work of public instruction, maintenance, and new construction has gone on very satisfactorily throughout the year. The school for gardeners is making good progress. The character of the instructional work offered and the methods of handling the students are being carefully studied and modified and adapted as experience shows the need. With the provision of an apprentice system with part pay for a limited number of promising young men who desire to become practical gardeners and foremen of estates, we may hope to have the nucleus of a permanent gardeners school such as is so much needed and has been long desired in this country.

The increase in wages and salaries which it is possible to provide on the basis of the new standard scale adopted by the city, supplemented by the Garden's own funds, coming as it does at a time when it is so much needed, marks an important advance and is strengthening in a very essential particular the position of the Garden among the other great educational and scientific institutions of the country. We may now confidently expect to continue, in the future as in the past, to command the services of men of the first rank in botanical science.

Respectfully submitted,

R. A. Harper,

Chairman of the Scientific Directors.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS AND MEMBERS FOR THE YEAR 1919

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 165. The number of annual members is now 979; life members 139; sustaining members 12; fellowship members 3.

Of these 24 are now in arrears for dues for 1919, 11 for dues for 1918 and 1919, 10 for dues for 1917, 1918 and 1919.

Dues have been collected to the amount of $10,080. Three persons have qualified as life members by the payment of $250 each. These sums have been transmitted to the treasurer.

A complete list of all classes of members to date is herewith submitted.

Benefactors

*Hon. Addison Brown,
*Andrew Carnegie,
Columbia University,
*Hon. Chas. P. Daly,
Daniel Guggenheim,
Murry Guggenheim,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
*Mrs. Russell Sage,
*Cornelius Vanderbilt.

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*Miss Catherine A. Bliss,
Dr. N. L. Britton,
*Hon. Addison Brown,
*Andrew Carnegie,
*Mrs. George Whitfield Collord,
*James M. Constable,
*William E. Dodge,
James B. Ford,
George J. Gould,
Edward S. Harkness,
*Mrs. Esther Herrman,
Archer M. Huntington,
*Henry Iden,

* Deceased.

Mrs. John Innes Kane,
*John Stewart Kennedy,
*J. Pierpont Morgan, Sr.,
*Oswald Ottendorfer,
*Lowell M. Palmer,
William Rockefeller,
*William R. Sands,
*William C. Schermerhorn,
*James A. Scrymser,
Mrs. Finley J. Shepard,
*Samuel Sloan,
Mrs. Frederick F. Thompson,
W. K. Vanderbilt,
Mrs. Antoinette Eno Wood.

Fellows for Life

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George F. Baker,
Miss Elizabeth Billings,
Mrs. W. Bayard Cutting,
Dr. Robert W. de Forest,
Cleveland H. Dodge,
James B. Ford,
Daniel Guggenheim,
Murry Guggenheim,
S. R. Guggenheim,
Mrs. John Stewart Kennedy,
Edward V. Z. Lane,
Mrs. Frederic S. Lee,
James McLean,
Ogden Mills,
George W. Perkins,
Mrs. John A. Roebling,
Mortimer L. Schiff,
Francis Lynde Stetson,
Miss Olivia E. Phelps Stokes,
Charles G. Thompson,
Louis C. Tiffany,
Tiffany & Company.

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Mrs. James Herman Aldrich,
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J. Sherlock Andrews,
Dr. S. T. Armstrong,
Edward W. C. Arnold,
Mrs. H. D. Auchincloss,
Samuel P. Avery,
Samuel D. Babcock,
Dr. John Hendley Barnhart,
George D. Barron,
Aurel Batonyi,
Gustav Baumann,
Samuel R. Betts,
William G. Bibb,
Miss Elizabeth Billings,
J. O. Bloss,
George Blumenthal,
G. T. Bonner,
Mrs.Addison Brown,
J. Hull Browning,
Joseph Bushnell,
T. Morris Carnegie,
Frank R. Chambers,
Hugh J. Chisholm,
Hugh J. Chisholm, Jr.,
Geo. C. Clark,
Banyer Clarkson,
Dr. James B. Clemens,

*Deceased.

Wm. F. Cochran,
William Colgate,
Miss Georgette T. A. Collier,
W. E. Connor,
Mrs. F. A. Constable,
Theodore Cooper,
Zenas Crane,
R. N. Cranford,
Melville C. Day,
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Roland R. Conklin,
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Mrs. William Harrison Day,
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Dr. Robert W. de Forest,
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Eugene Delano,
Moreau Delano,
William Adams Delano,
William C. De Lanoy,
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Miss Gertrude Dodd,
Cleveland H. Dodge,
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Charles E. Griffin,
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Miss Susan D. Griffith,
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George Bird Grinnell,
Mrs. Chester Griswold, Sr.,
George V. Gross,
William C. Gruner,
A. M. Guinzburg,
Mrs. Gurnee,
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Hon. Ernest Hall,
Wm. Halls, Jr.,
Mrs. Charles W. Halsey,
Wm. Hamann,
L. Gordon Hamersley,
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Mrs. William P. Hamilton,
Ferdinand Hansen,
J. Montgomery Hare,
E. S. Harkness,
Mrs. Stephen V. Harkness,
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William Hamilton Harris.
J. Amory Haskell,
Jacob Hasslacher,
Dr. Louis Hauswirth,
T. A. Havemeyer,
J. Woodward Haven,
Carroll Hayes,
Miss Caroline C. Haynes,
Mrs. R. G. Hazard,
Mrs. W. R. Hearst,
Wm. W. Heaton,
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Hancke Hencken,
Chas. Henderson,
Mrs.E. C. Henderson,
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Hugh Hill,
Mrs. Robert Hill,
Walter Hinchman,
Mrs. Samuel N. Hinckley,
B. Hochschild,
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Mrs. Robert Hoe,
Miss Mary U. Hoffman,
Bernhard Hoffmann,
Mrs. Bernhard Hoffmann,
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John Swift Holbrook,
Edwin T. Holmes,
Elkan Holzman,
Mrs. Elon Huntington Hooker,
Chas. H. Hoole,
Ernest Hopkinson,
Frederick B. House,
C. J. Housman,
Richard F. Howe,
M. D. Howell,
Mrs. Henry E. Howland,
John Sherman Hoyt,
Miss Rosina S. Hoyt,
Theodore R. Hoyt,
Miss V. S. Hoyt,
Walter C. Hubbard,
Mrs. Anna Huber,
Conrad Hubert,
Mrs. E. W. Humphreys,
Mrs. Thomas Hunt,
Mrs. H. E. Huntington,
Mrs. R. P. Huntington,
Dr. Lee M. Hurd,
H. D. Hutchins,
Frank DeK. Huyler,
Mrs. Clarence M. Hyde,
Henry St. John Hyde,
Edwin W. Inslee,

Adrian Iselin, Jr.,
C. Oliver Iselin,
Miss Georgine Iselin,
Lewis Iselin,
William E. Iselin,
Mrs. William E. Iselin,
Miss Flora E. Isham,
A. C. Israel,
Samuel K. Jacobs,
John S. Jacobus,
A. C. James,
Mrs. Arthur Curtis James,
Dr. Robert C. James,
Mrs. Wortham James,
E. C. Jameson,
Mrs. Alfred Jaretzki,
Alfred W. Jenkins,
O. G. Jennings,
Walter B. Jennings,
George S. Jephson,
Gilbert H. Johnson,
Mrs. T. W. Johnston,
Francis C. Jones,
Mrs. Townsend Jones,
Rodney Wilcox Jones,
Louis M. Josepthal,
Karl Jungbluth,
Henry M. Kahle,
Felix E. Kahn,
Louis Kahn,
Mrs. Delancey Kane,
Mrs. H. F. Kean,
Frank Browne Keech,
Henry F. Keil,
William W. Kelchner,
Prof. J. F. Kemp,
Mrs. H. Van Rensselaer Kennedy,
Mrs. John S. Kennedy,
David Keppel,
Rudolph Keppler,

John B. Kerr,
Emil L. Kieger,
Patrick Kiernan,
S. E. Kilner,
Darwin P. Kingsley,
Morris Kinney,
Warren Kinney,
W. Ruloff Kip,
William B. Kirkham,
Mrs. Gustav E. Kissel,
E. C. Klipstein,
Roland F. Knoedler,
Chas. Kohlman,
Marion B. Kohlman,
Alex. Konta,
Dr. George F. Kunz,
A. H. Kursheedt,
Anthony R. Kuser,
Adolf Kuttroff,
Mrs. Samuel W. Lambert,
Francis G. Landon,
Edward V. Z. Lane,
Woodbury Langdon,
Mrs. Jacob Langeloth,
Mrs. John J. Lapham,
Lewis H. Lapham,
Montgomery La Roche,
Henry G. F. Lauten,
Mrs. Amory A. Lawrence,
John Burling Lawrence,
Henry Goddard Leach,
Prof. Frederic S. Lee,
Lederle Antitoxin Laboratories,
Marshall C. Lefferts,
Wm. H. Lefferts,
George Legg,
S. M. Lehman,
James M. Lehmaier,
John E. Leikauf,
Wm. H. Leupp,
Edmund J. Levine,
G. Levor,
Louis S. Levy,
Montgomery H. Lewis,
Adolph Lewisohn,
Miss Alice Lewisohn,
Paul Lichtenstein,
E. K. Lincoln,
Frederick J. Lisman,
Lucius N. Littauer,
Mrs. John R. Livermore,
Miss Anna P. Livingston,
Mrs. Francis G. Lloyd,
Mrs. I. Ferris Lockwood,
Frank J. Logan,
Russell H. Loines,
Manuel Lopez,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Mrs. Seth Low,
August Lueder,
Walther Luttgen,
William M. Lybrand,
J. M. Richardson Lyeth,
S. Ma,
Mrs. C. B. Macdonald,
C. K. MacFadden,
Clarence H. Mackay,
Kenneth K. Mackenzie,
Mrs. Charles F. MacLean,
Malcolm MacMartin,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
J. G. C. Mantle,
Miss Delia W. Marble,
John Markle,
Mrs. John Markle,

Dr. J. W. Markoe,
Alfred E. Marling,
Otto Maron,
Mrs. Henry Marquand,
Edwin S. Marston,
R. W. Martin,
Dr. Walton Martin,
William J. Matheson,
Robert Maxwell,
George O. May,
Harry Mayer,
Mrs. R. de L. Mayer,
Dr. D. H. McAlpin,
Geo. L. McAlpin,
George McAneny,
Alfred McEwen,
Henry P. McKenney,
John A. McKim,
James McLean,
Edward F. McManus,
William McNair,
B. Frank Mebane,
Morton H. Meinhard,
Dr. Walter Mendleson,
Herman W. Merkel,
John L. Merrill,
Manton B. Metcalfe,
Herman A. Metz,
Eugene Meyer, Jr.,
Harry J. Meyer,
John G. Milburn,
Dr. Adelaide Mills,
Alex. S. Mitchell,
Mrs. John Murray Mitchell,
H. de La Montagne,
C. D. Montague,
Barrington Moore,
Clement Moore,
J. C. Moore,
Miss Katherine T. Moore,
Mrs. Paul Moore,
Russell W. Moore,
Victor Morawetz,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P. Morgan, Jr.
Mrs. Pierpont Morgan,
Wm. Fellows Morgan,
Mrs. Cora Morris,
Mrs. Dave Hennen Morris,
Dwight W. Morrow,
Henry C. Mott,
Mrs. John B. Mott,
Eric Muelberger,
Frank J. Muhlfeld,
Carl Muller,
John P. Munn,
Frank A. Munsey,
G. M. P. Murphy,
William S. Myers,
National Association, Boards of Pharmacy,
A. G. Nesbitt,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
William H. Nichols,
Wm. Nilsson,
George Notman,
Howard Notman,
Adolph S. Ochs,
John Offerman,
Mrs. Ponsonby Ogle,
P M. Ohmeis,
E. E. Olcott,
Miss Mary Olcott,
Elam Ward Olney,

Robert Olyphant,
Mrs. Emerson Opdycke,
Mrs. Wm. Openhym,
J. Oppenheim,
John B. O'Reilly,
William C. Orr,
Prof. Henry F. Osborn,
Mrs. William Church Osborn,
Miss Elizabeth H. Packard,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Mrs. Edgerton Parsons,
Miss Gertrude Parsons,
Mrs. Henry Parsons,
T. H. Hoge Patterson,
Mrs. Frederick Pearson,
Charles E. Peck,
Dr. Charles H. Peck,
Mrs. Wheeler H. Peckham,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
Edmund Penfold,
Mrs. William A. Perry,
Samuel T. Peters,
Mrs. Theodore Peters,
W. R. Peters,
Carl Schurz Petrasch,
Curt G. Pfeiffer,
Walter Pforzheimer,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Gottfried Piel,
Henry Clay Pierce,
Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
John Platt,
Edward Plaut,
Gilbert M. Plympton,
Miss R. A. Polhemus,
Miss Florence L. Pond,
Chas. Lane Poor,
Mrs. James Harper Poor,
James E. Pope,
Alexander J. Porter,
Mrs. Henry Kirke Porter,
Abram S. Post,
Miss Blanche Potter,
Frederick Potter,
Fuller Potter,
Mrs. George D. Pratt,
Mrs. Herbert Lee Pratt,
John T. Pratt,
Samuel Pratt,
Mrs. L. B. Preston,
Clinton B. Price,
Miss Cornelia Prime,
Thomas R. Proctor,
Mrs. Kate Davis Pulitzer,
H. St. Clair Putnam,
Miss Eva C. Putney,
Percy R. Pyne,
Charles F. Quincy,
Stanley Ranger,
G. B. Raymond,
Mrs. William A. Read,
Robert C. Ream,
Miss Emily Redmond,
Geraldyn Redmond,
John Reid,
Chas. Remsen,
Howard Price Renshaw,
Samuel W. Reyburn,

Mrs. E. S. Reynal,
Miss Elvine Richard,
Oscar L. Richard,
Eben Richards,
E. O. Richards,
Mrs. Robert Ridgway,
Wm. J. Riker,
Dr. Wm. C. Rives,
Miss Emeline Roach,
G. Theo. Roberts,
Miss G. Van B. Roberts,
Miss Jennette Robertson,
Louis J. Robertson,
Andrew J. Robinson,
William G. Rockefeller,
Edward L. Rogers,
Miss Harriette Rogers,
Hubert E. Rogers,
A. J. Rolle,
Clarence M. Roof,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Henry C. Ross,
Jacob Rossbach,
Peter W. Rouss,
C. H. Ruddock,
Louis Ruhl,
Justus Ruperti,
Jacob Ruppert,
Miss M. L. Russell,
John Barry Ryan,
Arthur Ryle,
Miss Julia Ryle,
Harry Sachs,
Samuel Sachs,
Clarence Sackett,
Mrs. Walter J. Salmon,
Mitchell Samuels,
Mrs. B. Aymar Sands,
Daniel C. Sands,
F. A. Sarg,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
Oliver H. Sawyer,
Hermann Schaaf,
Fred'k Müller Schall,
George E. Schanck,
John Scheepers,
Anton Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Charles A. Schieren,
Gustave H. Schiff,
Rudolph E. Schirmer,
C. P. Schlicke,
Miss Jane E. Schmelzel,
Fedor Schmidt,
D. Schnakenberg,
Henrich Schniewind, Jr.,
Louis B. Schram,
Rudolph Schreiber,
Henry Schreiter,
Richard Schuster,
B. Schutz,
C. M. Schwab,
Gustav Schwab, Jr.,
Frederick Schwed,
Walter Scott,
Miss Grace Scoville,
Robert Scoville,
The Scoville School,
Mrs. Arthur H. Scribner,
Edward M. Scudder,
Alonzo B. See,
Prof. Edwin R. A. Seligman,
Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,

Alfred Seton,
Mrs. William F. Sheehan,
Finley J. Shepard,
Hiram W. Sibley,
Alfred L. Simon,
John W. Simpson,
Francis Louis Slade,
Ralph E. Slaven,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Miss Fanny A. Smith,
Pierre J. Smith,
R. A. C. Smith,
E. G. Snow,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
Dr. Edward H. Squibb,
J. R. Stanton,
Mrs. Mary P. Eno Steffanson,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Roderick Stephens,
Benjamin Stern,
Sereno Stetson,
Mrs. Byam K. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Lispenard Stewart,
Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
Mrs. James Stokes,
Mrs. Willard Straight,
H. Grant Straus,
Roger W. Straus,
Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
Edward S. Strobhar,
Mrs. Gustaf Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Mrs. Theron G. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
E. T. H. Talmage,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
H. L. Terrell,
Mrs. John T. Terry,
Thomas Thacher,
Miss M. J. Thayer,
Mrs. Hector W. Thomas,
Mrs. Howard L. Thomas,
Percival Thomas,
Seth E. Thomas, Jr.,
Lewis M. Thompson,
Loren Ogden Thompson,
L. S. Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
James Timpson,
Rev. E. P. Tivnan, S. J.,

Mrs. Margaret T. Tjader,
J. Kennedy Tod,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
Mrs. Alice B. Tweedy,
E. S. Twining,
Lucien H. Tyng,
Oswald W. Uhl,
Mrs. Walter M. Underhill,
Theodore N. Vail,
Mrs. Henry C. Valentine,
James J. Van Alen,
Mrs. Frederick T. Van Beuren,
Barend Van Gerbig,
E. H. Van Ingen,
Mrs. Warner M. Van Norden,
Edgar B. Van Winkle,
Mrs. Wilbur Linwood Varian,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Alfonso P. Villa,
Mrs. Gustavus A. Walker,
James N. Wallace,
Leo Wallerstein,
Dr. Max Wallerstein,
Wm. I. Walter,
Artemus Ward,
Mrs. John I. Waterbury,
C. W. Watson,
Thomas L. Watt,
Mrs. E. H. Weatherbee,
H. Walter Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,
Charles H. Weigle,
Bernard Weinig,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Oliver J. Wells,
Arthur L. Wessell,
Dr. William West,
William Young Westervelt,
Miss Edith Wetmore,
Dr. Wm. E. Wheelock,
Alfred T. White,
Miss Caroline White,
Mrs. Stanford White,
Clarence Whitman,
Miss Margaret S. Whitney,
Elmore A. Willets,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
James R. Williston,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Dr. Margaret B. Wilson,
M. Orme Wilson,
Bronson Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Lewis S. Wolff,
William E. Wolff,
Prof. R. S. Woodward,
Miss Julia Wray,
Mrs. J. Hood Wright,
Mrs. A. Murray Young,
George A. Zabriskie,

Joseph A. Zanetti,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. George A. Armour,
Mrs. Robert Bacon,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. N. L. Britton,
Mrs. Charles D. Dickey,
Mrs. A. Barton Hepburn,
Mrs. Robert C. Hill,
Mrs. Wm. A. Hutcheson,
Mrs. Walter Jennings,
Mrs. Delancey Kane,
Mrs. Hamilton F. Kean,
Mrs. Gustav E. Kissel,
Mrs. A. A. Low,
Mrs. Charles Mac Veagh,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Mrs. George D. Pratt,
Mrs. Harold I. Pratt,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Benson B. Sloan,
Mrs. Theron G. Strong,
Mrs. Henry O. Taylor,
Mrs. W. G. Thomson,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

NEW YORK, January 12, 1920

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my Receipts and Disbursements during the year 1919, and Balance Sheet from my Ledger as of December 31, 1919.

Respectfully submitted,

JOHN L. MERRILL,
Treasurer.

RECEIPTS AND DISBURSEMENTS

Receipts

Balance brought forward, December 31, 1918.....		$ 25,844.61
Sale of Investments		
Investment Guggenheim Greenhouse Fund, $30,000 New York Central Notes.....$29,818.75		
Investment of Science and Education Fund,$40,000 Northern Pacific Railway Co.....	39,390.00	$ 69,208.75
Income from General Investments credited to General Income Account		
5% on $50,000. Southern Ry. 1st Consolidated Mortgage Bonds.....$2,500.00		
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds.....	2,250.00	
4% on $50,000 Erie Railroad Co. Prior Lien Bonds...	2,000.00	

4% on $59,000 Erie Railroad Co. Penn. Coll. Trust Bonds.....	2,360.00	
4% on $50,000 Reading R. R. Co. Bonds, Jersey Central Coll. Tr.....	2,000.00	
4% on $24,000 Northern Pac. R. R. St. Paul, Duluth Divn.....	960.00	
4% on $35,000 Northern Pac. R. R. Bonds, Gt. Nor. C. B. & Q. Trust ..	1,400.00	
5% on $10,000 Louisville & Nash. R. R. Eqpt. Notes.....	500.00	
4% on $10,000 New York City Stock due 1959....	400.00	
4½% on $10,000 N. Y. Cent. Lines Eqpt. Notes	450.00	
4% on $11,000 Milwaukee, Sparta & No. West. R. R. Bonds.....	440.00	
4½% on $50,000 Pennsylvania R. R. Genl. Mtge. Bonds.....	2,250.00	
5% on $10,000 Balto. & Ohio R. R. Bonds.....	500.00	
5% on $50,000 Great Nor. R. R. Coll. Trust Gold Notes, 6 mos.....	1,250.00	
5% on $40,000 Great Nor. R. R. Co. Coll. Trust Bonds, to date of sale...	1,581.95	$ 20,841.95
Income from Investment of Addison Brown Fund, 4% on $22,000 Nor. Pac. Prior Lien Bonds.....		880.00
Income from Investment of John Innes Kane Fund, 5% on $10,000 Gt. Nor. Railway Co. Bonds.....		500.00

Income from Investment of Guggenheim Greenhouse Fund, interest on N. Y. Central Notes.....		802.78
Income from Investment of Maria DeWitt Jesup Fund,		
4% on $15,000 Nor. Pac. Prior Lien Bonds.....$600.00		
4¼% on $10,000 Liberty Loan Bonds..... 425.00		1,025.00
Interest on Deposits, being interest at 3% on balances with J. P. Morgan & Co. for the year 1919.		412.13
Interest on Liberty Bonds, subscribed for by employees and not redeemed.....		44.64
Membership Fees and Dues		
Sustaining Members' Fees.$ 300.00		
Annual Dues..... 9,480.00		9,780.00
Subscriptions to "North American Flora," Sales of Publications, credited to Income of David Lydig Fund.....		2,127.31
Subscriptions to "Addisonia," credited to Income of Addison Brown Fund		2,590.35
Sundry Sales, credited to Income of Stokes Fund.		3.50
Contribution for Horticultural Prizes by The Horticultural Society of New York, credited to Income of Wm. R. Sands Fund....		161.50
Income of Chas. B. Robinson Fund...		31.59
Contributions from New York City towards Maintenance..... ...		92,239.72
Other Contributions		
To Students' Research Fund. .....$	100.00	
To Special Fund for Books.	811.00	
To Plant Fund.....	573.00	
To Exploration Fund.....	350.00	

To Museum and Herbarium Fund		400.00	
To Cherry Garden Shelter Fund		2,000.00	
To Reserve Fund		250.00	
To Grounds Improvement Fund		4,930.00	
To Convalescent Soldiers' Garden Fund	3,325.50	12,739.50	
Sale of Junk		187.90	
Vouchers Paid, Refund		9.35	
Repayments by Employees for Liberty Bond Subscriptions		$ 12,391.13	$225,977.10
			$251,821.71

Disbursements

Expenses paid through Director-in-Chief

Account of New York City Appropriations	$ 92,239.72
General Account for vouchers paid.	27,361.01
Guggenheim Greenhouse Fund	55,104.60
Cherry Garden Shelter Fund	1,161.00
Grounds Improvement Fund	4,710.19
Convalescent Soldiers' Garden Fund	3,198.00
Emergency Fund	1,044.84
Reserve Fund	24,730.26
Publications, debited to Income of David Lydig Fund	2,230.90
Publications, debited to Income of Addison Brown Fund	2,767.84
Income of Maria DeWitt Jesup Fund	722.28
Income of Students' Research Fund	150.00
Income of D. O. Mills Fund	1,120.96
Income of Science and Education Fund	4,909.67
Income of Stokes Fund	2.20
Income of John Innes Kane Fund	20.15
Income of Wm. R. Sands Fund	141.00

Special Fund for Books	85.08	
Plant Fund	882.42	
Exploration Fund	300.00	
Museum and Herbarium Fund	351.46	$223,233.58

Sundry Accounts

Interest on Liberty Bonds, subscribed for by Employees, paid for by the Garden	$ 176.79	
Subscriptions to Liberty Bonds for Account of Garden Employees	12,400.00	12,576.79
Balance December 31, 1919, on deposit with J. P. Morgan & Co.		16,011.34
		$251,821.71

Ledger Balances, December 31, 1919

Credit

Permanent Funds

Endowment Fund	$268,760.00
Endowment Fund, for Science & Education	83,461.90
David Lydig Fund, Bequest of Charles P. Daly	34,337.86
Legacy of Wm. R. Sands	10,000.00
Darius Ogden Mills Fund	50,000.00
Henry Iden Legacy	10,000.00
Addison Brown Legacy	21,850.00
John Innes Kane Fund	10,000.00
Stokes Fund	3,000.00
Charles Budd Robinson Memorial Fund	705.44
Students Research Fund	4,124.00
Maria DeWitt Jesup Legacy	25,000.00
	$521,239.20

Temporary Funds

Cherry Garden Shelter Fund	839.00
Reserve Fund	13,019.74
Grounds Improvement Fund	358.16
Convalescent Soldiers' Garden Fund	3,459.57
Investment of Guggenheim Greenhouse Fund, profit on Investment.	1,590.63

Income Investment Maria Dewitt Jesup Fund	167.76	
Income David Lydig Fund	1,745.53	
Income Students' Research Fund	530.41	
Income Stokes Fund	126.04	
Income John Innes Kane Fund	539.98	
Income Addison Brown Fund	2,126.11	
Income Charles Budd Robinson Fund	49.49	
Special Fund for Books	861.16	
Plant Fund	232.93	
Exploration Fund	74.05	
Museum and Herbarium Fund	74.62	$ 25,795.18
Grand Total		$547,034.38

Debit

General Investments

$50,000 Ches. & Ohio Genl. Mtg. Bonds 50,000 So. Ry. Co. 1st Cons. Mtg. Bds. 50,000 Erie R. R. Co. Prior Lien Bds. 59,000 Erie R. R. Co. Penn. Coll. Tr. Bds. 50,000 Reading R. R. Co. J. C. Coll. Tr. Bds. 24,000 Nor. Pac. R. R.-St. P. & D. Div. Bds. 30,000 Nor. Pac. Gt. Nor.-C. B. & Q. Coll. 10,000 N. Y. City 4% Stock 1959	$312,424.18

Investment, D. O. Mills Fund

$50,000 Penn. R. R. Genl. Mtg. Bonds, 4½%	$ 50,418.33

Investment, Science & Education Fund

$10,000 N. Y. Cent. Lines Eqpt. 10,000 Louisville & Nashville Eqpt. 10,000 Balto. & Ohio Refunding Genl. Mtg. Bds. due Dec. 1995, 5% 5,000 Chic. Burlington & Quincy R. R. Jt. 4s. July 1, 1921 10,000 Gt. Nor. Rwy. 5% Gold Notes due Sept. 1, 1920	$ 45,142.36

Investment, Henry Iden Fund

$11,000 Milwaukee, Sparta & No. W. R. R. Bonds.	10,120.00

Investment, Addison Brown Legacy	
$22,000 Nor. Pac. Prior Lien Bds. 4%.....	21,380.69
Investment, John Innes Kane Fund	
$10,000 Gt. Northern Rwy. Co. 5% Gold Notes due Sept. 1, 1920.....	10,015.62
Investment, Maria De Witt Jesup Fund	
$15,000 No. Pac. Prior Lien Bonds, 4% $10,000 Liberty Bonds, Third Loan. }	23,378.75
Director-in-Chief Working Fund.....	30,000.00
General Income Account	
Balance borrowed from Permanent Funds.....	25,750.29
Guggenheim Greenhouse Fund.....	126.80
Interest on Employees' Liberty Bonds	
To be borne by the Garden.....	102.15
Employees' Liberty Bonds	
Due from Employees.....	2,163.87
Cash in Hands of Treasurer	
On deposit with J. P. Morgan & Co.....	16,011.34
	$547,034.38

Treasurer's Account for the Year 1919

Room 318, Grand Central Terminal
New York, May 18th, 1920

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and nineteen (1919), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

I have also examined the various investment securities and find the same to be as reported in the said balance sheet.

Respectfully submitted,
A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1919

Room 318, Grand Central Terminal
New York, May 18th, 1920

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and nineteen (1919), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the then Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

Respectfully submitted,
A. W. Stone,
Special Auditor.

BULLETIN
OF
The New York Botanical Garden

Vol. 10 No. 40

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1920

(*Accepted and ordered printed January 10, 1921*)

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: I have the honor to submit my report for the year ending January 10, 1921.

The maintenance and development of the institution have proceeded during the year, with many noteworthy additions to the collections, and with marked improvements to the grounds. Extensive repairs to buildings have been made and repair work needs to be continued. Plantations, lawns, trees, and woodlands have been maintained in health and beauty, vandalism having been kept in check, except for a few irritating incidents; high autumnal gales felled a number of forest trees. The path system has been extended, especially at the new iris garden and its approaches; the cherry garden shelterhouse was completed and path approaches built up to it; work upon the much needed fence along the Southern Boulevard was commenced in the autumn and the entrance to the horticultural gardens there was nearly completed. The new iris garden within the horticultural grounds was built and planted and much progress was made in constructing and planting the new fern garden and the adjoining rock garden at the southern end of the herbaceous grounds. The dahlia collection was much increased and the plantation extended;

a gift of some 20,000 tulip-bulbs from the General Bulb Growers Society at Haarlem should form a highly attractive feature in the horticultural gardens next spring. Extensive additions were made to the orchid collection in conservatory range 2, and the collections in the central display greenhouse have developed luxuriantly. In conservatory range 1, the palm collection has been much improved by rearrangement and the cactus collection has been greatly increased.

Public instruction through Saturday and Sunday afternoon lectures in the museum building and in the central display greenhouse attracted interested audiences and the docentry system has been increasingly appreciated. Instruction in gardening was continued and advanced students and visiting investigators in botany and related subjects have made good use of the collections and library. A very large amount of information about plants, their cultivation and their products, has been given out to visitors and in reply to letters. The labelling of all collections has been continued.

Exploration and collecting were carried out in Florida, Cuba and Trinidad, yielding important accessions of living plants, museum and herbarium specimens. Much work was accomplished in rearranging museum collections and in adding specimens held in storage to the exhibition cases.

About 14,782 species and varieties of plants have been grown during the year, of these about 5,332 out of doors and about 9,450 in the greenhouses. Many of these were represented by a large number of individual plants, many by one or few. The library now contains about 29,950 volumes, an increase during the year of 270 volumes. It has proved impossible under existing conditions to get bookbinding done at all rapidly and we have a considerable accumulation of unbound volumes. Additions to museum and herbarium collections aggregate some 16,569 specimens.

Publications during 1920 include Nos. 38 and 39 of the *Bulletin;* Volume 21 of the *Journal;* 3 parts of *North American Flora;* Volume 12 of *Mycologia,* 3 parts of the fifth volume of *Addisonia,* and 11 numbers of *Contributions.* An annotated catalogue of specimens in the economic museum is in press to form a part of Volume 11 of the *Bulletin.*

Plants and Planting

Through valued cooperation with the American Iris Society a very extensive new collection of irises has been planted in the area of the horticultural gardens south of the herbaceous garden, under the supervision of Dr. Gleason, Assistant Director; details of this installation may be found in his report hereto appended.

Dr. Southwick, Custodian of the Herbaceous Grounds, has supervised and personally constructed a new and large fern-garden at the base of the rocky hill at the southern end of the herbaceous garden valley; he has collected and planted there many of the hardy ferns of our region in large quantities and has assembled many more for planting there in the spring; he has also accomplished much work in transforming this hill into a large rock garden, and it is proposed that he prosecute these works to completion next season; they cannot fail to be very attractive and instructive additional features.

Dr. Howe, Curator, largely increased the collection of Dahlias planted in the border at the railroad station,* and this was of great interest and beauty throughout the autumn.

All other plant collections were in charge of Mr. Nash, Head Gardener and Curator of the Plantations, assisted by Foreman Gardeners Becker and Finley and by Mr. Hartling, his immediate assistant; Mr. Boynton, Supervisor of Gardening Instruction, aided when his other duties permitted. Not much change was made in the

* See Journal N. Y. Bot. Gard. 21: 138.

plantations already established, other than additions, substitutions and replacements, and the transferral of some of the greenhouse collections from one house to another to effect better display or to obtain better cultural conditions. Details may be found in the report of Mr. Nash hereto appended.

Museums

The arduous task of rearranging and cataloguing the specimens forming the economic museum was completed by Dr. Rusby, with the assistance of Mr. Williams, and progress has been made in the publication of the annotated catalogue of this very important collection; this will be a noteworthy contribution to plant economics; about one-third of the proof has been read.

In pursuance of the plan adopted in 1919, the herbarium collections of algae were moved from the upper floor of the museum building to the west hall of the second floor, and the space occupied by them utilized for library expansion. Details of work accomplished may be found in the report of the Head Curator, and in those of the honorary curators hereto appended.

Library

Much needed additional shelving for octavo and quarto books was obtained through the special development fund, as elsewhere reported and will provide for library expansion for some time, but folios need more shelving. The need for a special library fund, noted in my last annual report, has been met in part through a bequest of $30,000 by Mrs. Fanny Bridgham, received during the year, the income of this fund having been made available for the purchase and binding of books by request of the Scientific Directors, granted by the Board of Managers; this will yield about $1,500 a year; we also have the income of the Henry Iden Fund of $10,000, a bequest from Mr. Iden, received several years ago, yielding $500 an-

nually, already specified for the purchase of books, and some books may be bought from the income of the Maria De Witt Jesup Fund of $25,000, bequeathed by Mrs. Jesup and specified for the increase of the collections, while others may be had from the Special Book Fund, made up of contributions for the purchase of books. The ordinary increase of the library is thus at least partly provided for; some very expensive sets of desirable books offered for sale at intervals may need to be secured through other sources of income.

As recorded in the report of the Librarian, hereto appended, the library now contains just about 30,000 volumes.

Exploration and Collecting

A set of the important collections made by Dr. A. S. Hitchcock, Agrostologist of the United States Bureau of Plant Industry in British Guiana during the latter part of 1919 and in January 1920, referred to in my last report, was received during the summer,* and has since been partly studied. I was occupied for about ten weeks in the early part of the year in botanical collecting on the island Trinidad with a party of assistants;† we obtained a fine series of specimens illustrating the vegetation of that island, which have mostly been studied and incorporated into the permanent collections. Both Dr. Hitchcock's expedition and mine were carried out under the cooperative arrangement entered into by us with the United States National Museum and the Gray Herbarium of Harvard University for the increase of knowledge of the flora and plant products of northern South America and adjacent islands.‡ This investigation has proved to be very important, resulting already in large accessions of specimens and of plants not hitherto represented in our collections and in new highly valuable scientific informa-

* See Journal N. Y. Bot. Gard. 21: 129–137.

† See Journal N. Y. Bot. Gard. 21: 101–118.

‡ See Journal N. Y. Bot. Gard. **19**: 182–185. 1918; and Science N.S. **53**: 29, 30. 1921.

tion; it is desirable that field work should be prosecuted as actively as possible with any funds that may be made available and plans for 1921 contemplate several expeditions for which provision has already been made.

Dr. Small, Head Curator, continued field work in Florida and elsewhere in the southeastern states in the spring and in the autumn, made possible by the liberal financial aid of Mr. Charles Deering, and obtained extensive and important series of plants and specimens which have been partly studied; some of Dr. Small's observations on these trips and on previous ones have been published during the year.*

Large collections of specimens made in Cuba by our valued correspondents Brother Leon, Brother Hioram and Dr. Juan T. Roig have added much to knowledge of the vegetation of that island and have made more complete the catalogue of the Cuban Flora.

Public Instruction and Information

Public instruction by lecturers and by docents has been continued. Lectures have been delivered on Saturday afternoons from February 21 to December 11, either in the museum building or in the central display greenhouse, and on Sunday afternoons during the spring and autumn in the museum building; the Sunday afternoon lectures, first given this year, were received with much appreciation and it now appears desirable to have them delivered through the summer as well as in spring and autumn. A special lecture fund or funds with available income of about $2,000 a year, for the payment of lecturers other than members of the staff, and for sundry lecture expenses would provide much needed addition to endowment.

Instruction by docents has also been continued, with increasing requests for this service. Dr. Murrill, Supervisor of Public Instruction, Mr. Williams, Administrative Assistant, Mr. Wilson, Associate Curator, and Mr. Becker,

* See Journal N. Y. Bot. Gard. 21: 25–38; 45–54; 81–86; 161–178.

Foreman Gardener, have done most of this work, one of them having been available at all times to escort parties of children or adults to parts of the grounds and buildings, explain the collections and answer questions; all other members of the staff have, however, participated in such instruction, which is very effective and highly appreciated.

The correspondence of the institution in replying to requests for information about plants of all kinds and plant products continues to be very extensive.

Details of this work may be found in the report of the Supervisor of Public Instruction hereto appended.

Instruction of convalescent soldiers in practical gardening, commenced early in 1919, was continued, with a decreasing number of students, until November, when our arrangements with the Federal Board for Vocational Education were terminated. During the time of this work 84 convalescent soldiers were given instruction for longer or shorter periods. A few of them developed fondness for gardening, but the great majority did not, and these will probably be more useful in other occupations. Those who appear to be likely to take advantage of their opportunities have been permitted to remain as apprentices. All these students were greatly benefited in health while at the Garden, and this was, perhaps, the most important result to be obtained.

A few civilians have been enrolled as gardening students and have done good work, but it would appear that the establishment of an apprentice system with remuneration is the more likely to be satisfactory.

We are continuing the position of Supervisor of Gardening Instruction into 1921, however; Mr. Boynton's detailed report on instruction given during 1920 is hereto appended.

Buildings and Bridges

Much of the large amount of repair work on buildings outlined as necessary in my last annual report was ac-

complished, but much remains to be done, especially on the roof of conservatory range 1 and in rebuilding the benches for plants in four of the houses there. Details of the work accomplished may be found in the report of the Superintendent of Buildings and Grounds hereto appended.

The wooden bridge over the Bronx River, beautifully located in the north meadows, built of chestnut a number of years ago, at the time we were obliged to remove many trees killed by the chestnut blight, is deteriorating. We have had approved plans for a permanent concrete bridge at this point for several years awaiting available funds for building it and these are now very much needed, inasmuch as the path system has meanwhile been constructed up to this important crossing on both sides of the river, and we may be obliged to close the chestnut bridge as a precautionary measure; the cost of the concrete bridge would be from $8,000 to $10,000.

All the other bridges are in good condition; the unique boulder bridge at the northern end of the hemlock grove continues to excite the wonder and admiration of many visitors.

Boundary Fences and Entrances

During former years substantial fences were constructed, where required, along the boundaries of the original reservation, except along the northern boundary line; these fences along the property-line of Fordham University and along a part of the Bronx Boulevard boundary were built through city appropriations; that along the right of-way of the New York Central and Hudson River Railroad was built by that railroad company under permission from and agreement with the Garden; driveway and path entrances were built where needed.

The avenue and parkway boundaries of the land added by the city to the original reservation in 1915 have remained unfenced, no city appropriations for such con-

struction having been obtainable. During the year the Board of Managers decided to prosecute this much needed construction by any funds available and as rapidly as practicable. A bequest of $5,000 by Mrs. Mary J. Kingsland was appropriated for fence construction along the Southern Boulevard and for the entrance to the horticultural gardens from that avenue, and the foundation, walls and piers of this fence were built for about 500 lineal feet during the latter part of the year, the purchase of the iron railing required to complete this length being deferred, anticipating lower cost; an appropriation by the Board of Managers of $7,500 from the income of the Russell Sage and Margaret Olivia Sage Memorial Fund is available for the continuation of this fence southward toward Pelham Avenue, and appropriations from this fund of the same amount have been made for the three following years. A bequest received from Mrs. Louisa Combe, $5,280, has been appropriated by the Board of Managers for fencing along the Pelham Parkway, including the Mansion Approach Entrance.

The total length of fencing required, including the northern boundary along the Bronx River Parkway, is about 5,000 lineal feet, with four driveway and path entrances and four path entrances. The foregoing appropriations provide for about 3,500 lineal feet of fence, one driveway and path entrance, and one path entrance, leaving about 1,500 feet of fence, three driveway and path entrances and three path entrances to be provided for.

All the fence built along the Bronx Boulevard and about one-half of that along the property-line of Fordham University was repainted during the year.

Roads, Paths and Grading

The driveways have been maintained as heretofore by the City Department of Parks, in accordance with the provisions of the Garden's charter under the efficient direction of Park Commissioner Joseph P. Hennessy, to

whom we are also indebted for other valued cooperation and advice. Work upon the unfinished part of the driveway leading east from the rose garden, referred to in my report of a year ago, was continued by the Park Department, but the funds available from the city appropriation proved insufficient to complete it. In order to ensure its completion we took advantage of opportunity, commencing in December, to accomplish the remaining Telford paving and the grading of banks necessary and this work is now essentially completed, having been made possible by continued mild weather. The broken trap-rock for the macadam layer has been obtained and stacked by the Park Department. It now remains to use a steam-roller, for which provision has been made, spread the broken stone and obtain sufficient trap-rock screenings for surfacing and to oil the surface, all of which we hope, through further cooperation with the Park Department, to accomplish next year. The opening of this road will complete the driveway system of the Garden reservation as planned. It will sooner or later become necessary, however, to widen the present narrow road leading south from the rose garden to Pelham Parkway, as we have realized for some time.

The path system has been maintained by laborers under the direction of Foreman Gardener Finley; considerable resurfacing was accomplished and considerable needs to be done. New paths at the new iris garden and approaching it, aggregating 970 lineal feet in length and ten feet wide, were completely built, and 850 lineal feet were graded and made ready for the rock foundation which it is planned to supply during the winter from necessary grading operations near the museum building; the paths approaching the new cherry-garden shelter-house from the south and east, aggregating 280 lineal feet, ten feet wide were nearly completely built. The path leading south from the rose-garden stairway, commenced last autumn, was completed, as also the path leading southwest from the mallow garden along the western side of the driveway

there, and some work was done on the path along the western side of that driveway, the southern portion of it being completed.

The necessary construction of the new iris garden paths prevented our doing any work on the much needed Bronx River paths leading north along the river from the Linnaean Bridge referred to in my last report, but we hope to build at least one of them next season.

Grading, regulating, sodding and draining operations, requiring much time and labor, were necessary during the work of path-building and the construction of the new iris garden.

Details of work on roads, paths, grading and collateral operations may be found in the report of the Superintendent of Buildings and Grounds hereto appended.

Water Supply

The work of extending the 4-inch water-supply in order to obtain higher pressure at the mansion mentioned in my last annual report was satisfactorily completed during the spring.

Natural Features

The beauty of the natural woodlands, meadows, river-banks and river-cliffs within the reservation remains undiminished. The forested areas, including the hemlock grove, are in normal health and luxuriance and their maintenance has been restricted to the removal of wind-falls, very much fewer in number than the young trees which are growing up in them. Some of the iron-railing bought through the special development fund may be used to extend the railing of trails, noted as desirable in my report for 1919.

Special Development Fund of 1920

For the development of parts of the grounds, publication of a new guide-book, increase of collections, and additional

library and herbarium cases, purposes for which no ordinary funds were available during the year, members of the Garden were asked to subscribe to a special development fund and the following contributions were received:

SPECIAL DEVELOPMENT FUND OF 1920

Dr. Robert Abbe	$ 25
Mr. Edward D. Adams	500
Mr. J. E. Aldred	10
Mrs. James Herman Aldrich	10
Mr. Oakes Ames	25
Anonymous	5,000
Dr. S. T. Armstrong	25
Mrs. B. Arnold	5
Mrs. E. S. Auchincloss	5
Mr. Samuel P. Avery	10
Mrs. Robert Bacon	25
Mr. G. V. N. Baldwin, Jr.	5
Dr. Otto F. Behrend	10
Mr. Frank N. Bell	5
Mr. E. P. Bicknell	50
Mr. Abraham Bijur	25
Miss Elizabeth Billings	25
Mrs. William H. Birchall	10
Mrs. C. Ledyard Blair	25
Mr. George Blumenthal	25
Miss R. C. Boardman	5
Mr. William H. Bolton	5
Mr. George D. Brewster	100
Mrs. W. T. Bush	10
Mr. Charles Stewart Butler	5
Mr. H. W. Cannon	10
Mr. Frank R. Chambers	10
Miss Frances H. Close	10
Mr. C. A. Coffin	50
Miss Mary Compton	10
Mrs. Jonathan H. Crane	10
Mr. Paul D. Cravath	100
Mr. R. L. Crawford	10
Mr. George A. Crocker, Jr.	10
Mr. James W. Cromwell	100
Mr. Frederic A. Dallett	20
Mr. Charles Deering	250
Mrs. John Ross Delafield	10
Mr. Moreau Delano	50
Mr. Wm. Adams Delano	10

Mr. W. D. Despard	10
Mr. J. Henry Dick	25
Mrs. Charles D. Dickey	50
Mr. George H. Diehl	5
Mr. Cleveland H. Dodge	100
Miss Ethel Du Bois	20
Miss Katharine Du Bois	50
Mrs. Coleman du Pont	25
Mr. John E. Dwight	10
Mrs. F. H. Eaton	10
Mr. Howard Elliott	10
Mrs. A. B. Emmons	10
Mr. S. M. Evans	10
Mr. Samuel W. Fairchild	20
Mr. William C. Ferguson	25
Mr. Eugene G. Foster	10
Mrs. Helen M. Fox	400
Mr. A. S. Frissell	20
Mr. Abraham L. Goldstone	10
Mrs. W. R. Grace	20
Mr. Daniel Guggenheim	500
Mr. Murry Guggenheim	500
Miss Elizabeth Stewart Hamilton	5
Mrs. W. P. Hamilton	10
Mr. Edward S. Harkness	500
Miss Josephine T. Harriot	10
Dr. Louis Hauswirth	5
Miss Caroline C. Haynes	25
Mr. Hancke Hencken	10
Mr. Philip W. Henry	5
Mr. & Mrs. Bernhard Hoffmann	200
Mr. Theo. R. Hoyt	25
Mr. Edwin W. Inslee	5
Mr. Adrian Iselin	25
Mr. E. C. Jameson	25
Mr. A. W. Jenkins	25
Mr. Karl Jungbluth	10
Mr. Felix E. Kahn	25
Mrs. John I. Kane	200
Professor James F. Kemp	10
Mrs. John S. Kennedy	25
Mr. Charles Kohlman	10
Mr. E. V. Z. Lane	200
Dr. A. R. Ledoux	50
Mr. G. Levor	25
Mr. Russell H. Loines	10
Mrs. Seth Low	10
Mr. Kenneth K. Mackenzie	50

Mr. V. Everit Macy	25
Mr. R. W. Martin	5
Mr. Emerson McMillin	100
Mr. B. Frank Mebane	5
Mr. John L. Merrill	10
Mrs. William F. Milton	50
Miss Katharine T. Moore	25
Mr. J. P. Morgan	500
Mrs. J. P. Morgan, Jr.	50
Mrs. Dave H. Morris	20
Dr. Lewis Rutherfurd Morris	100
Mr. Eric Muelberger	10
Mme. Elie Nadelman	5
Mr. George Notman	100
Mr. Howard Notman	5
Mrs. Ponsonby Ogle	10
Miss Mary Olcott	5
Mrs. Henry F. Osborn	10
Mr. Charles Lathrop Pack	50
Mr. Charles H. Peck	5
Mrs. Wheeler H. Peckham	5
Mr. E. S. Pegram	5
Mr. George W. Perkins	250
Mr. W. H. Perkins	100
Mrs. Frank H. Platt	10
Miss Florence L. Pond	10
Mr. Abram S. Post	10
Miss Blanche Potter	15
Miss Eva C. Putney	5
Mr. Charles F. Rand	100
Mr. G. B. Raymond	15
Miss Emily Redmond	20
Miss Elvine Richard	25
Mr. William J. Riker	10
Dr. William C. Rives	25
Mrs. John A. Roebling	300
Mrs. W. Emlen Roosevelt	5
Mr. Arthur Ryle	50
Mr. F. A. Sarg	10
Miss G. W. Sargent	10
Mrs. Herbert L. Satterlee	50
Mr. D. Schnakenberg	25
Miss Grace Scoville	25
Mrs. James A. Scrymser	500
Mrs. Finley J. Shepard	25
Mr. Alfred L. Simon	10
Mrs. Benson B. Sloan	50
Mr. Pierre J. Smith	10

Dr. Edward H. Squibb	10
Mr. Frederic W. Stevens	5
Mr. Chauncey Stillman	25
Mrs. James Stokes	10
Miss Ellen J. Stone	25
Mr. Frederick Strauss	25
Mrs. Gustaf Stromberg	50
Mrs. Theron G. Strong	50
Mr. Joseph Stroock	10
Mr. F. K. Sturgis	200
Mrs. James Sullivan	5
Mrs. Henry O. Taylor	100
Mr. Samuel Thorne, Jr.	10
Mr. Louis C. Tiffany	100
Mr. Henry N. Tifft	10
Mr. Alfred Tuckerman	5
Mr. Oswald W. Uhl	10
Mr. William I. Walter	25
Mr. Artemas Ward	20
Mrs. C. Gouverneur Weir	5
Miss Edith Wetmore	5
Mr. W. P. Willis	25
Mr. Frank D. Wilsey	10
Mr. John C. Wister	20
Mr. George A. Zabriskie	10
Mr. Charles Zoller	5
Total	$13,485

Through this highly appreciated cooperation, the preliminary construction of the new iris garden and the new fern garden, together with their paths and a portion of their path-approaches, was accomplished, and the new collection of hardy lilies, obtained through Mrs. Fox's contribution, made for this purpose, was partly installed; six new steel stacks of bookshelves and six new herbarium cases were bought and various minor improvements were effected.

Reports Appended

I append reports made to me by Dr. Gleason, Assistant Director; by Dr. Small, Head Curator; by Dr. Murrill, Supervisor of Public Instruction; by Mr. Nash, Head Gardener; by Dr. Stout, Director of the Laboratories;

by Mr. Boynton, Supervisor of Gardening Instruction; by Mr. Corbett, Superintendent of Buildings and Grounds; by Dr. Barnhart, Bibliographer; by Miss Harlow, Librarian; by Dr. Hollick, Honorary Curator of Fossil Plants; by Mrs. Britton, Honorary Curator of Mosses; by Dr. Rusby, Honorary Curator of the Economic Collections; and a schedule of expenditures by Mr. Groesbeck, Bookkeeper.

Respectfully submitted,
N. L. BRITTON,
Director-in-Chief

REPORT OF THE ASSISTANT DIRECTOR

DR. N. L. BRITTON, Director-in-Chief.

Sir: I have the honor to submit herewith my annual report as First Assistant and Assistant Director.

Besides carrying on the usual routine of administrative duties, as delegated to me by yourself, I have devoted my attention to various improvements planned to increase the efficiency of Garden operation. During your absence in Trinidad during the winter and in England in the late summer and early autumn, I took entire charge of the administrative work of the Garden and desire to express my appreciation of the sound advice so frequently needed and so generously given by the members of our Board of Managers and Scientific Directors, and of the loyal cooperation by the members of our staff.

At the beginning of the year, about fifty former soldiers were receiving training in gardening under the direction of Kenneth R. Boynton, Supervisor of Garden Instruction, and in cooperation with the Federal Board for Vocational Education. Mr. Boynton was assisted by Walter B. Balch and E. E. Watson, and occasionally by other members of the staff. The number of students enrolled had decreased in the summer, and a new contract was made with the Federal Board, effective November 1, by which the Garden was assured sufficient income from fees to

meet the necessary expenses. The Board of Managers, at their meeting of November 18, authorized negotiations with the Federal Board with a view to terminating the contract. This was done, and the school in its old form ceased December 2.

The Scientific Directors, at their meeting of December 11, authorized the continuation of not more than six of the former students as apprentice gardeners, without wages from the Garden and without the payment of fees by the Federal Board. This plan was put into effect December 13, with four men, and its progress will be watched with much interest.

In the meantime, attempt was made in the spring and early summer to establish the apprentice gardener system with four boys, from 16 to 18 years of age. One boy, James Granville, aged 16, began work in August, and has been uniformly satisfactory.

During your absence in England, the requests for appropriations for 1921 were submitted, through the Park Department, to the Board of Estimate of the City of New York. Inspectors visited the Garden repeatedly through August and September and approved each of our requests without change in the amounts except a small reduction in one item. The total amount appropriated, however, falls short of our request by about $37,000, and compels us to postpone many urgent repairs or else provide our own funds for them.

The Botanical Garden has received more valuable publicity than heretofore. Several articles appearing in the *Journal* have been reprinted or reviewed by scientific or trade periodicals, while the unusually successful displays of tulips in the spring and of dahlias in the summer and autumn, as well as other features, were well covered by the daily press. A number of special articles, dealing with the more interesting features of the Garden, have also been published, particularly in the *New York Times*.

Partly because of newspaper publicity calling attention to special displays of growing plants, partly because of the housing situation in the city, and doubtless for other reasons as well, the number of visitors in the Garden has been notably greater than ever before. On pleasant Sundays they enter our grounds at the Elevated Railway Entrance at a rate as high as one hundred per minute, while other entrances add considerable numbers. Although our grounds are large enough to prevent actual congestion, still the problem of caring for so many visitors, of directing them to places of interest, of providing them with benches and otherwise aiding their personal comfort, of guarding against petty depredations, of cleaning the grounds of litter, is sufficient to tax our resources to the utmost without satisfactorily meeting the situation. The chief present needs in caring for our regular Sunday crowds include the improvement of the old comfort stations and the erection of new ones, the distribution of more benches about the grounds, the provision of more receptacles for waste, the erection of path railings and warning signs, and the employment for Sunday duty of several more keepers. These matters are already receiving official attention.

Although conditions on the grounds on week days are entirely different, more labor is needed in picking up litter left on Sunday and more keepers are urgently needed as patrols through the grounds to prevent minor depredations by boys and thoughtless or careless adults. Additional police protection is also a highly important desideratum.

Various societies and clubs have used our grounds and buildings throughout the year and are reported in detail by the Supervisor of Public Instruction. Of special interest among them was the American Iris Society, which was organized in the Mansion January 29. Shortly after its organization the Society entered into an agreement with the Garden, after approval by our counsel, for the establishment of a trial and demonstration garden of

Iris on our grounds. Construction of this garden was begun in the spring, through the aid of the Special Development Fund, and plantings were made in the late summer and autumn. While the garden is not yet completed, it already contains 559 named varieties of Iris, and an unusual display is expected for the spring of 1922.

The annual Spring Inspection was held Thursday, May 6.

I have served as editor of the *Journal* throughout the year, with the assistance of Dr. Pennell at certain times. Volume 21, for 1920, contains 238 pages and 12 full page plates. Increased cost of printing has compelled me to limit its size as much as possible, with the unavoidable result that many articles and notes have been omitted. *Addisonia* and *Mycologia* have appeared as usual through the year. Bulletin 38, the guidebook for the museums, greenhouses, and grounds, appeared June 30, containing 114 pages and 28 plates. Bulletin 39, the annual report for 1919, with 94 pages, was published June 30.

During the year 11 numbers of the *Contributions* have been published, aggregating 389 pages and 9 plates, as follows:

212. Scrophulariaceae of the Local Flora, by Dr. Francis W. Pennell.

216. Some Applications of the Quadrat Method, by Dr. H. A. Gleason.

217. Further Experimental Studies on Self-incompatibility in Hermaphrodite Plants, by Dr. A. B. Stout.

218. Observations on Monosporangial Discs in the Genus *Liagora*, by Dr. M. A. Howe.

219. Scrophulariaceae of the Central Rocky Mountain States, by Dr. Francis W. Pennell.

220. Notes on Rosaceae—XII, by Dr. P. A. Rydberg.

221. Scrophulariaceae of the Southeastern United States, by Dr. Francis W. Pennell.

222. The Land of Ferns. The Habitats and Distribution of the Fernworts of Florida, by Dr. J. K. Small.

223. Calymperaceae of North America, by R. S. Williams.

224. Phytogeographical Notes on the Rocky Mountain Region. IX. Wooded Formations of the Montane Zone of the Southern Rockies, by Dr. P. A. Rydberg.

227. Scrophulariaceae of Colombia—I, by Dr. Francis W. Pennell.

While it is in many ways desirable that the research activities of the members of the Garden staff should be given publicity through diverse channels, it is in other ways to be regretted that our own publications are not able to handle all of our scientific papers.

My personal research through the year has been directed to a continuation of studies on the South American species of *Siphocampylus* and *Centropogon*, in which notable progress has been made, in spite of insufficient material. The studies have already revealed a wealth of undescribed species in these two genera in the mountains of Colombia and Ecuador and serve to illustrate and emphasize the great need of further botanical exploration in northern South America, a work in which the Garden is already actively engaged.

Besides the Contribution mentioned above, I have published during the year, six short articles and have submitted several short abstracts to the editor of *Botanical Abstracts*

Finally, it is a pleasure to record the general improvement in the *esprit de corps* of the entire Garden personnel, due to increase in salaries and the reduction in the cost of living, and the better condition of our growing plants and our material equipment, due to the efficient work of our faithful employees, the reopening of conservatory range 2, and the increased funds available for maintenance.

Respectfully submitted,

H. A. Gleason,

Assistant Director

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Curator of the Museums and Herbarium for the year 1920.

The several collections, both the public exhibits and the research material, were cared for and developed as in preceding years.

The materials acquired during the year represent a wide geographic range, but the more important additions came from continental and insular America. The specimens received during the year were accessioned in detail from month to month in the *Journal*. The accession lists there recorded may be summarized as follows:

Specmens receiived through			gifts and purchases	4,972
"	"	"	exchanges	2,489
"	"	"	exploration	9,108

Thus a total of 16,569 specimens was added to the resources of our permanent and duplicate collections. The value of the specimens received as gifts is estimated at $269. About 3,790 duplicate specimens were sent to other institutions as exchanges. In return we have received specimens or credit.

Museums

The public exhibits were maintained as in the previous year. No new equipment was added, but miscellaneous specimens were interpolated and extensive rearrangements of specimens were effected in the economic museum.

Economic Museum

Numerous specimens were added to this exhibit chiefly through the personal activity and efforts of Dr. Rusby, Honorary Curator of the Economic Collections. These additions were made throughout the various divisions and

all specimens were rearranged and the exhibits put in final sequence—the results of several years work on this collection. It now contains over 8,000 specimens.

The labelling of the new specimens was begun by the use of a temporary typewritten label. These labels will ultimately be replaced by the standard printed label.

The Systematic Museum

The four divisions comprising this museum were maintained as heretofore.

The Synoptic collection was increased by the addition of specimens in some of the lower groups of plants.

The Local Flora was also made more complete by the addition of specimens in the lower groups and by illustration to represent plants not suitable for exhibition in the frames.

The Microscope Exhibit was maintained unchanged, except for the replacing or renewal of specimens.

The Plant Picture Exhibit was not enlarged, although many photographic prints are held in reserve awaiting additional frames in which to display them.

The Fossil Plant Museum

More than fifty specimens were added to this museum. They were from near the arctic circle, Alaska, on the one hand, and from near the equator, Trinidad, on the other. A beginning has been made in replacing worn labels in the public exhibits.

Herbarium

Specimens totalling 16,227 were received during the year. The geographic distribution represented was almost world-wide, but the more important additions, at least as far as the present work of the Garden is concerned, came from the Continental United States, Mexico, the West Indies, northern South America, and the Philippine Islands.

Selections from the accessions of the year and from those of previous years, amounting to 32,000 specimens were mounted and incorporated in the permanent collections.

This addition represents 18,940 herbarium sheets. No new equipment was added to the herbarium, but considerable shifting of specimens was necessary owing to the uneven development of the different plant-groups. The complete rearrangement, on the Engler and Prantl sequence, of the fern herbarium was completed and all the accumulated mounted fern specimens were distributed into their proper places. Work was concluded on the arrangement of the unmounted herbarium material so that specimens can be consulted when necessary or desirable.

The local flora herbarium was increased by the addition of selected specimens brought together by the personal efforts of members of the garden staff and by specially arranged exchanges.

Investigations and Assistance

The curatorial work was performed by the several curators and associate curators, some of whom have also participated in or cared for various other matters and all of whom have followed, incidentally, some line or lines of investigation connected with Garden activities.

Dr. P. A. Rydberg, Curator, continued in charge of the herbarium of phanerogamic plants. The mechanical work this year has mainly been confined to the distributing of recently mounted specimens. His taxonomic work on the families Carduaceae and Fabaceae has been continued. Of the former, the manuscript for one part of North American Flora has been delivered to the editor and enough for half a part in addition is practically ready. Of the Fabaceae, one part, containing the second half of the tribe Psoraleae, was published in January. The tribes Indigofereae and Galegeae are all but ready except the subtribe Astragalaneae of the latter. The manuscript prepared will almost be enough for two more parts. Two articles were published in the *Bulletin of the Torrey Botanical Club:* "Notes on Rosaceae XII," and "Phytogeographical Notes on the Rocky Mountain region XI."

Dr. Marshall A. Howe, Curator, continued to have charge of the collections of Algae and Hepaticae. His principal publications of the year have been an account of the algae of the Bahamas, comprising sixty-six pages of Britton and Millspaugh's *Bahama Flora*, which appeared in June, and a paper entitled "Observations on Monosporangial Discs in the Genus *Liagora*" contributed to the *Bulletin of the Torrey Botanical Club*. He has given considerable time to the study of specimens of marine algae obtained by several expeditions to Porto Rico, and also to distributing duplicates of Bahama algae. Somewhat more than 3,400 specimens were sent to twenty-one institutions in the United States and Europe, especially to those in which studies of the marine algae are being carried on and with which exchange relations have been established. Dr. Howe has given four lectures in the Saturday afternoon courses during the year, and has conducted a special course in the study of the algae. He has continued to act as an associate editor of the publications of the Torrey Botanical Club and as a member of the Council of the New York Academy of Sciences. As a collateral line of activity he has again had charge of the dahlia border, which has developed into one of the most popular attractions of the Garden.

Dr. Fred J. Seaver, Curator, was in charge of the collections of lower fungi, the higher fungi being looked after by Dr. W. A. Murrill. Collecting and research have been continued on the various groups of ascomycetes especially the cup-fungi. Manuscript on the genus *Phyllosticta* has been practically completed for North American Flora. Considerable time has been used in compiling a list of the species of Porto Rican fungi to be used by Dr. Britton in his flora of Porto Rico; also in the study of the genus *Phyllachora*, a group of parasitic fungi which are especially abundant in the tropics. Several papers were published during the year and one lecture was given in the regular Saturday afternoon course. A number of museum speci-

mens were added to the collection and to the public exhibit of the local rusts. Work was continued on destructive insects and one trip made to Long Island to inspect the elm trees on the grounds of the Sage Foundation Home Company which were thought to be dying from a fungus disease, but which were found to be victims of the elm borer. A few days were spent in Pennsylvania collecting specimens in collaboration with Pennsylvania State College, Cornell University, and Syracuse University.

Mr. Percy Wilson, Associate Curator, devoted considerable time to determining and distributing collections of tropical American plants, especially those from the West Indies and South America. He has also received for determination from specialists of other institutions many specimens of tropical American plants on which parasitic fungi occur. His duties as docent continued three afternoons each week, and he also had charge of many of the special students and classes that availed themselves of the opportunities thus offered by the Garden. In this way over 1,200 students came under his personal instruction.

Dr. Francis W. Pennell, Associate Curator, in addition to curatorial duties, continued his studies on the Scrophulariaceae. During April and May he collected this and related groups in the western Gulf States and later in the year he published papers on the Scrophulariaceae of the southeastern States, the central Rocky Mountain States, and Colombia. Studies of this family in other parts of the New World are in preparation, and he began monographing the tribe Gratioleae for North American Flora. A bibliographic index, preliminary to the study of the related families, Solanaceae, Bignoniaceae, and Gesneriaceae, was commenced. Dr. Pennell had especial charge of the local herbarium, and also delivered lectures, in the garden course and elsewhere, on the Southeastern United States and Colombian floras.

The writer, in addition to the general and detailed curatorial duties connected with the public and research collections, continued his studies in systematic and regional botany, especially in relation to the plants of the southeastern United States. Articles for the *Journal* and *Addisonia* were written, and several were published. Two papers also appeared in the journals of other institutions. The recent discoveries connected with the box-huckleberry, and the problems involved, as well as range-extension of certain prickly-pears, led him to devote a few days in August to explorations in the Delaware peninsula and in eastern Pennsylvania. Besides general herbarium specimens and various living specimens, he secured colonies of the box-huckleberry from the three known wild plants for transplanting in the Garden. He devoted several weeks, during the early spring and the late fall, to exploration and study in Florida. The special objects of search and investigation in the field were palms (*Pseudophoenix*, *Pauro-tis*), cacti (*Opuntia*, *Harrisia*), wild-pepper plants (*Peperomia*), lilies (*Crinum*), spider-lilies (*Hymenocallis*), coonties (*Zamia*), and century-plants (*Agave*). Success attended all the writer's efforts, and living specimens in quantity were brought together for study-plantations under glass at the Garden and in the open in Charles Deering's reservations at Buena Vista and at Cutler, Florida, where almost unlimited facilities for experimenting and investigation, as well as for exploration, have been put at his disposal by Mr. Deering. The cactus plantation at Buena Vista, which has already been of such signal service in connection with your studies in the Cactaceae, was enlarged through your generosity as well as through that of others. A century-plant plantation was installed at Cutler, to which specimens were contributed from the duplicate collections of the Garden. Numerous experiments in planting and in the effects of environment were incidentally inaugurated in both reservations referred to above during periods of field-work in Florida. The main results of the field work,

as well as those of studies in the plantations, have been embodied in papers which will appear in future issues of the Garden *Journal.*

The reports of Dr. H. H. Rusby, Honorary Curator of the economic collections, Mrs. Elizabeth G. Britton, Honorary Curator of Mosses, and Dr. Arthur Hollick, Honorary Curator of fossil plants, appear elsewhere.

Respectfully submitted,
JOHN K. SMALL,
Head Curator of the Museums and Herbarium.

REPORT OF THE SUPERVISOR OF PUBLIC INSTRUCTION

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1920.

Instruction has been given free to the public in a variety of ways during the year and has been much appreciated. The lecture course was considerably extended and more outside lecturers were secured. Instruction by correspondence has also notably increased. A new edition of the guide-book was issued early in the year.

Lectures

Forty-five illustrated public lectures on botanical and horticultural subjects have been given in the museum building on Saturday and Sunday afternoons from April 17 to October 31 inclusive, the titles of which have been published in the *Journal.* Of these 22 were given by members of the garden staff and 23 by lecturers from the outside. The attendance for the year has averaged about 99, the maximum being 287 on September 25. The Sunday lectures were better attended in the spring and the Saturday ones in the autumn.

During the early spring and late autumn two courses of six lectures each were given in the central display greenhouse of conservatory range 2, where plants could be used to illustrate them. The speakers were exclusively members

of the garden staff. Much interest has been shown in the continuation of these lectures, the attendance increasing considerably during the year and averaging 42 for the autumn series.

School Lectures and Demonstrations

Several classes in biology from various public high schools have visited the garden for the study of living plants and museum collections and for lectures in our lecture hall. These have been under the general direction of the school teachers, guided by myself and assisted by various members of the garden staff.

Docentry

It is difficult to estimate the number of persons who have received personal attention from the department of public instruction during the year, assisted by Mr. Wilson, Mr. Williams, Mr. Becker, and other members of the Garden staff. The few groups of visitors mentioned below will indicate the character and scope of this work.

The North Country Garden Club, presided over this year by Mrs. Beekman Winthrop, of Westbury, Long Island, made a field-day excursion to the New York Botanical Garden on the afternoon of Wednesday, May 19. The Nature Committee of the Good-Citizenship League, of Flushing, Long Island, consisting of about twenty ladies, arrived at the Garden May 17 at ten-thirty o'clock and remained all day. About 60 pupils in the summer school of Columbia University, accompanied by Mr. L. W. Crawford, Jr., visited the Garden on the afternoon of August 9 and were shown through portions of the grounds and buildings.

Meetings

Several meetings have been held at the Garden by Societies interested in botany and horticulture, the members having been shown through the grounds and buildings while in attendance.

The Wild Flower Preservation Society and the Torrey Botanical Club held a joint meeting at the Mansion June 2. The chief feature of the program was an address by Dr. Homer D. House, State Botanist, on "The Wild Flowers of New York." His remarks were illustrated by colored lantern slides and by plates from his new publication on the same subject.

The annual meeting of the Woman's National Farm and Garden Association was held in the Mansion of the New York Botanical Garden on May 25, Mrs. Francis King presiding. After the luncheon, at which Mrs. Charles D. Norton was hostess, a walk was taken through the hemlock grove and herbaceous valley to the tulip beds in the conservatory court. The weather was fine and the flowers in superb condition. A lecture by Professor L. H. Bailey, the distinguished horticulturist and agriculturist, on "Co-operation in Agriculture" concluded the program for the day. This association has increased rapidly in numerical strength and is becoming an important influence in bringing the producer and consumer together.

The American Rose Society held a regular meeting at the Garden September 29. The members first assembled at the Mansion at 10:30 A.M. and at 10:45 visited the Rose Garden. After a luncheon in the tea-room of the Mansion, there was a business meeting in the adjoining lecture hall, followed by an interesting program. At 3 o'clock the visiting guests were taken on a tour of inspection through portions of the grounds and buildings, including the hemlock grove, the new iris garden, the herbaceous grounds, conservatory range 1, the flower gardens in the vicinity, and the dahlia collection.

Floral Exhibitions

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of flowers in the museum building on the dates given below.

The collections of irises, peonies, roses, dahlias, etc., on the grounds also attracted large crowds of people.

May 8, 9. Exhibition of Flowers.
June 12, 13. Exhibition of Roses, Peonies, and Irises.
August 21, 22. Exhibition of Gladioli.
September 25, 26. Exhibition of Dahlias.

Personal Investigations

A large share of the time I could spare from public instruction has been devoted to work on *Mycologia* and two guide-books, one covering the buildings and grounds and the other the economic museum.

A little mycological field-work was done during my vacation in Virginia and the southern Catskills. Two articles on resupinate polypores, containing descriptions of many new species, have been prepared and published during the year.

Respectfully submitted,
W. A. Murrill,
Supervisor of Public Instruction.

REPORT OF THE SUPERVISOR OF GARDENING INSTRUCTION

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1920.

With the return of the students from the Christmas vacation on January 5, the instruction in gardening was continued according to the revised curriculum. The practical work was continued at the conservatories and the propagating houses, by groups under the supervision of our instruction assistants, foreman gardeners, and myself, and by individual work with our gardeners in the various houses.

After the general greenhouse practice of midwinter, such as potting, tubbing, cleaning, watering, and ventilating, the chief exercises of propagation were carried out. Practice in seedage proceeded on a large scale with annual and perennial flowering plants for our borders and with

vegetable plants, many of which were grown on to transplanting size, and used in the students' vegetable gardens.

With the coming of spring and settled weather, the outdoor work was taken up. The first to engage our attention was vegetable gardening. After the lectures on this subject given by Mr. Walter Balch were finished, the students planned their own gardens; these were laid out on the site of the school garden plots of last year, and were divided into about five gardens of four-student size, two gardens of three-student size, and seven gardens for individuals. Nearly all of the common vegetables were grown, and with greater success than in the previous year. The soldier students, especially those with families, were supplied through the summer and fall with fresh vegetables, grown by themselves.

The large gladiolus collection was again planted by the students, and occupied the same space as before. The other spring practice consisted mainly in cleaning, spading, and lining up the flower beds near range No. 1, and the transplanting of annual flowering plants into these beds. After planting time, the students were divided in groups and located at various places on our grounds for further practice under our gardeners. This was continued until November, when they were returned to the greenhouses.

The class work for the year was given through the spring, autumn and winter months and omitted during the summer. Elementary botany was given half day weekly during January, February, and March, by Mr. Elba E. Watson and again in the autumn by Dr. Stout, three days weekly from November 15th. During April, May and June, Mr. Watson gave a course in plant diseases, on alternate weeks with Dr. E. B. Southwick's course on destructive insects. My course in garden botany was continued throughout the year, one or two hours weekly being devoted to walks and talks around the grounds and greenhouses. During January, February, March, and April,

Mr. Walter Balch gave a course of lectures on vegetable gardening on alternate Wednesdays, the rest were devoted to flower garden talks by myself.

In the autumn classes in arithmetic and English were given by Mr. Walter Law, one hour daily, and in elementary garden design by Mr. George V. Nash. The reading room in the Mansion was used for study and reference, and the lecture hall there for most of the lectures and laboratory work.

Mr. Walter Balch resigned on May 31, Mr. Elba E. Watson on July 10, and Mr. Walter Law on December 7.

The number of students registered ranged from 56 in February through 34 in June and July, to 27 in September, and 18, the lowest mark, which was reached in October.

Respectfully submitted,
KENNETH R. BOYNTON,
Supervisor of Garden Instruction.

REPORT OF THE HEAD-GARDENER AND CURATOR OF PLANTATIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF,

Sir: I have the honor to submit herewith my report as Head-Gardener and Curator of Plantations for the year 1920.

Systematic Plantations

HERBACEOUS GROUNDS. Including those at the nurseries, the herbaceous collections have comprised during the past year about 3,450 species and varieties; the herbaceous grounds have 130 beds, 26 east of the brook and 104 west. The custodian of the herbaceous grounds, Dr. E. B. Southwick, has been in charge of the work here, as well as in the economic garden and morphologic garden. The area devoted to the ferns and their allies is in process of rebuilding and replanting under his direction.

FRUTICETUM. In this collection there are now 2,953 specimens. The hardy shrub collections, including those still at the nurseries, represent 52 families, 144 genera, and 1,085 species and varieties.

SALICETUM. The collections here remain as they were last year: 159 specimens, representing 2 genera and 39 species and varieties.

DECIDUOUS ARBORETUM. Here there are 1,120 specimens. The collection of deciduous trees contains, including those at the nurseries, 430 species and varieties, representing 31 families and 60 genera.

PINETUM. There are 1,720 specimens in this collection; they represent 3 families, 20 genera, and 267 species and varieties.

VITICETUM. There are 51 species and varieties represented here.

CONSERVATORIES. The collections under glass have representatives of 207 families, about 9,450 species and varieties.

Range 1. During the past year considerable changes have been made here in the arrangement of the collections. House 1 remains as before, the repository of the large palm specimens and a few specimens of other families. Houses 2 and 3 are now devoted to the collections of tropical exogens. House 4 contains, as before, large specimens of tropical plants. Houses 5 to 8, as formerly, have the desert collections. In house 9 there has been no change. House 10 is now devoted entirely to the arum family, the pineapple family having been removed to range 2. House 11 remains as before, with the exception of the removal of the specimens of the pine-apple family to range 2. House 12 contains tropical endogens. In house 13 are the palms requiring somewhat cooler treatment than those in houses 1 and 15, and also other specimens requiring similar conditions. House 14 is at present vacant, but when the repairs are completed it will be devoted to specimens of the palm and panama-hat-plant families. House 15 contains specimens of palms. In houses 2, 3, 14, and 15 the central benches have been removed, thus permitting placing there larger specimens than was formerly possible, and greatly adding to the appearance of the collections.

There are here 8,034 plants, distributed as follows: house 1, 300, house 2, 708; house 3, 861; house 4, 438; house 5, 1,365; house 6, 459; house 7, 1,043; house 8, 664; house 9, 146; house 10, 516; house 11, 422; house 12, 718; house 13, 168; house 14, empty; house 15, 226.

Range 2. The collections have been re-arranged to some extent, the collection of bromeliads, formerly at range 1, having been brought here. The numbering of the houses has been somewhat changed, as follows: the central house is known as the Central Display House; the houses to the north have been given even numbers, while those planned for the south will bear the odd numbers. Signs bearing these designations have been placed at the entrances to all houses.

There are here 6,309 plants, distributed as follows: central display house, 600, cool-house plants; house 2A, 945, cool-house orchids; house 2B 727, intermediate-house orchids; house 4, 70; house 6A, 668, bromeliads; house 6B, 716, stove-house orchids; house 8B, 179; house 10, 1,050, ferns and fern allies, with a few cycads; house 14, 1,080, cool-house plants; house 16, 40, cycads; house 18, 136, tree ferns and other large fern specimens; house 20, 98, tree ferns and other large fern specimens.

Propagating Houses and Nurseries. House 3 and a part of house 4 have been used by the soldiers and sailors in their class work; the Director of the Laboratories has had the use of a part of house 4 and house 2; houses 5 and 6 contain the study collection of cacti; houses 1 and 7, with small areas in the other houses, have been available for propagating purposes. There are here, exclusive of the plants used by the Director of the Laboratories, 4,634 plants.

Labeling, Recording and Herbarium

The work here has been in charge of the head gardener's assistant with a label boy for a part of the time. The following labels have been prepared: deciduous arboretum, 25; fruticetum, 254; conservatory range 1, 206; conserva-

tory range 2, 89; conservatory beds, 177; horticultural gardens 176; rose garden, 95; dahlia collection, 430; conservatory court, 116; for doors at range 2, 42; pinetum, 144, total, 1,754.

Accession numbers 47,782 to 49,193 have been recorded, making a total of 1,412 accessions.

The number of packets of seeds received was 1,713, as follows: by gift 58; by purchase, 172, by exchange, 1,468; collected, 15.

The following plants have been received: by gift, 24,494 (including 17,575 tulip bulbs given by the General Bulb Growers' Society at Haarlem, and 5,481 tulip bulbs given by John Scheepers, Inc.), valued at about $6,000; by exchange, 414; by purchase (including miscellaneous bulbs), 6,198; by collection made by members of the staff and others, 241; derived from seeds from various sources, 1,362; total, 32,709. 310 specimens have been added to the herbarium of cultivated plants.

The collections, including those native to the tract, now comprise approximately 241 families, 2,200 genera, and 14,702 species and varieties.

Miscellaneous Collections

Here are included the following, in which no important changes have been made during the year: morphologic garden; economic garden; collections of desert plants placed during the summer in the court of conservatory range 1; conservatory lily pools; aquatic garden; rhododendron collections in the vicinity of the lakes, at conservatory range 1, and in front of the museum, the last collection having been re-arranged, all plants but the rhododendrons having been eliminated from that group; rose bed east of conservatory range 1; flower gardens in the immediate vicinity of conservatory range 1, and at the elevated approach; American wood garden; magnolia garden; American thorn garden; white pine plantation; red pine plantation; lilac and peony garden.

Changes have been made in the following collections:

Rose Garden. Owing to the unusually severe winter of 1919–20 the mortality here was much greater than common, although the plants were protected as usual. It was the weaker kinds that succumbed, the standard varieties presenting no more than the customary percentage of loss. Arrangements have been made with the Horticultural Society of New York, in accordance with the agreement with that organization, for the replacement of the losses.

Horticultural Gardens. A total of 28 beds were maintained here during the year. 3 beds were devoted to cannas, including 49 kinds and 1,759 plants. 1 bed accommodated a collection of 64 kinds of variegated plants. The collection of hardy chrysanthemums formerly located at the west border was transferred here, and many new kinds added. There were 81 kinds and 646 plants in 2 beds. The collection of phlox remained as last year. 8 beds were occupied by the collection of gladioli, containing 229 kinds and 16,821 plants. In the development of the new iris garden 13 beds were opened, containing 559 kinds and 1,493 plants. A bed 75 feet long and 10 feet wide, located along the path just south of the herbaceous grounds, was prepared for a lily collection, given by Mrs. Mortimer J. Fox; up to the present about 500 bulbs, representing 18 kinds, have been received and planted.

Dahlia Collection. Owing to the increase in the number of kinds and number of plants available for this collection amounting this year to 500 kinds and 730 plants, it was necessary to provide additional accommodations. A portion of the west border south of the railway station plaza was therefore allotted as additional area for the collection, which was assembled and planted, as heretofore, under the direction of Dr. M. A. Howe.

Chrysanthemum Collection. This was removed from the west border to the horticultural gardens.

Collection of Tulips. At the horticultural gardens and in the beds at the court of conservatory range I have

been planted this fall large collections of tulips, comprising a total of 323 kinds and 32,830 bulbs, of the following varieties and quantities:

	Var.	Quan.		Var.	Quan.
Breeder	84	7,752	Early, double	7	265
Darwin	166	17,554	Bizarre	3	35
Cottage	56	3,272	Rembrandt	1	10
Cottage, double	2	2,852	Miscellaneous	5	120
Early	10	970			

General Horticultural Operations

This work has been accomplished by the following force; monthly, 2 foreman gardeners and 29 gardeners; laborers, 14.

Foreman gardener John Finley has had charge of the details of the outside work, and there were assigned to him 9 gardeners and the laborers. Foreman gardener H. W. Becker has had supervision of the details of the work in the conservatories and propagating houses, and to him was assigned the remainder of the force.

In the spring the collection of rhododendrons in front of the museum was re-arranged, and all plants except rhododendrons were transferred to other decorative plantations. The pruning of shrubbery and trees, and of the roses in the rose garden and elsewhere, the planting of the large collections of gladioli, cannas, variegated plants, and dahlias, the removal of the chrysanthemum collection from the west border to the horticultural gardens, the planting of some conifers in the systematic collections, and at the fountain at the foot of the museum approach, and the removal of some of the thorns from the circle at the fruticetum, together with the usual maintenance, occupied the season.

In the fall the specimens of arbor vitae in front of the museum were re-arranged, being graded more according to height. The large collections of dahlias, gladioli, and cannas were removed, labeled, and properly stored. About 150 rose bushes were planted in the rose garden, and about

500 others received too late for planting in the fall, were heeled in at the nursery and will be planted as early as possible in the spring. The bushes in the rose garden were thoroughly protected by hilling up the earth around them and by a mulch also, this precaution also being taken for the hybrid perpetuals, as many of them suffered severely during the winter of 1919–20.

Investigations and Lectures

I have continued my studies of horticultural botany and of the orchids, have acted as one of the editors of *Addisonia*, my supervision of the drawings for that periodical being continued, and have given three of the lectures in the public courses at the museum and three in the courses at the central display greenhouse.

Respectfully submitted,

GEORGE V. NASH,

Head Gardener and Curator of Plantations.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to present the following report for the year 1920.

General Matters

The laboratories have been maintained during the year in equipment and supplies as was necessary to meet the needs of members of the Staff and of the research students of the Garden.

Use of an experimental greenhouse and of the breeding plots has been resumed during the past year on something like the pre-war basis. At the present time the breeding plot is being enlarged to give increased facilities and especially to provide for the growing of grapes.

A beginning has been made in the establishment of a vineyard concerning which I have frequently consulted with you. It is planned to extend the planting of grapes to include as many as possible of the wild species and the

most important of the cultivated varieties. Plants, and particularly seedlings, which appear to be promising or are especially interesting as to grade of intersexualism are also to be assembled for observation and use in breeding. The matter of providing greenhouse facilities for growing grapes under glass awaits consideration. As now planned, these plantings of grapes will serve at least three purposes. They will demonstrate the methods of growing the best varieties of native and *vinifera* grapes, the species assembled will furnish material for a critical study of species, and opportunity will be afforded for breeding experiments in cooperation with the State Agricultural Experimental Station at Geneva.

For several years I have made preliminary studies and experiments in the growing and breeding of species of *Lilium*. I am, therefore, especially pleased to report that through the interest and generosity of Mrs. Mortimer J. Fox, we are now able to prosecute more vigorously this project. Bulbs have been obtained for as many species as are readily obtainable in the market and I have collected about 200 bulbs of native wild species. Other species will be obtained as soon as possible. These will be used in two ways as follows:

(1) With the cooperation of Mr. Nash, Head Gardener, display beds are being planted for the interest of the general public. In developing these, special attention will be directed to a study of the cultural needs of the various species and of their value in floricultural planting.

(2) It is the plan to make a study of variation within the species, to test the possibility of producing more varieties by hybridization, and to continue and extend the studies of the type of sterility characteristic of several of the species. The plants used in these special experiments will be grown at the experimental greenhouse and in the breeding plots where they can be kept under control.

Much of this research with *Lilium* will be prosecuted by Mrs. Fox. I shall advise and cooperate as fully as may be desirable.

The routine duties incident to my position have been duly performed. Meteorological data have been taken and properly recorded. Programs for the monthly conferences of the Staff and registered students have been arranged and reports of these have been published in the *Journal.* I have given four public lectures at the Garden during the year.

During the spring months the Garden cooperated with Dr. D. T. MacDougal, Director of Botanical Research of the Carnegie Institution, in installing a dendrograph to a tree of the sugar maple and securing the records. At your direction, I took charge of the apparatus and sent all records to Dr. MacDougal.

On July 1st, the position of technical assistant in the laboratories, vacant for two years previous, was filled by the appointment of Miss Hester M. Rusk, who is now assisting me in the discharge of various routine duties and in prosecution of research.

Personal Investigations

As noted in my previous reports, the greater part of my personal research is being directed to studies of fertility and sterility concerning which I have already published several papers. I have now investigated numerous species in which the various types of sterility are operating. The study and survey of all types of sterility in plants is being extended as fully as time and facilities permit. There has been some opportunity to apply what is being learned about sterility and fertility to crops in which production of fruit and the breeding from seed are matters of practical as well as scientific interest. My cooperation with the Experiment Station at Geneva, N. Y., in the study of the grape, for which I have your permission, is perhaps a logical result of my researches on intersexualism.

In general, my studies of fertility during the past year may be grouped according to the type of sterility and the problems chiefly involved as follows: (1) the relation of vegetative vigor to reproductive vigor, (2) intersexualism, or inherent variations in the relative development of stamens and pistils, and (3) physiological incompatibility.

It may be reported that the investigations of the past two years indicate that sterility in certain species of *Lilium* and *Hemerocallis* which are propagated exclusively by vegetative means is due to incompatibilities in fertilization rather than to direct correlation with vegetative reproduction. To fully prove this point, at least for certain species, wild plants from the native home of the species are desired for study and efforts to secure these are being made.

Cultures of *Lythrum Salicaria* have yielded interesting results both as to sterility from compatibility and sterility from intersexualism, a report of which is in preparation.

In all of the studies mentioned above, the question of heredity has been very fully considered. Cytological studies of phenomena of fertilization in these plants are being made chiefly by the technical assistant, Miss Rusk.

During the period of the war, only a few plants of the principal varieties of *Coleus*, obtained as bud sports, were kept living. Studies with these have been resumed and the hereditary value of the segregations giving bud sports is now being tested by seedling progeny.

The various lines of research noted above are planned so that the attention required is well distributed over the entire year. The *Brassicas* are grown as winter and early spring crops; the grapes demand especial attention in spring and late autumn; the *Lythrums* and the Irish potatoes are summer crops, etc. This distribution facilitates the work and promotes economy in labor and in the full use of greenhouses and breeding plots.

Students and Scholars

During the year the following persons were formally registered for research at the Garden or were utilizing facilities of the Garden in connection with studies for degrees at Columbia University.

Findlay, Hugh,	Genetics. Fertility, sterility and heredity in *Abutilon*.
Gershoy, Alexander,	Taxonomy.
Hamanaka, Koshin,	Genetics.
Hastings, George Tracy,	Ecology. Algae.
Lebau, Harry,	Mycorrhiza of Orchids.
Nishimura, Makoto,	Algae.
Raines, M. A.,	Pathology.
Smith, Edna Louise,	Taxonomy.
Thomas, Harry Earl,	Pathology and genetics.

The degree of Ph.D. in botany was granted at Columbia University during the year to Harvey E. Thomas, Frederick V. Rand, and Makato Nishimura, whose researches were in part prosecuted at the Garden.

Of botanists who have spent some time in resident research at the Garden mention should be made of Professor William A. Setchell, Professor Forman T. McLean, and Professor William C. Coker. Numerous persons have utilized the facilities of laboratories, herbaria, and library as visiting investigators for short periods of time, and note of these has in many cases been made in the Garden *Journal*.

Respectfully submitted,
A. B. Stout,
Director of the Laboratories.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1920.

Regulating and Grading

Most of this work was accomplished in the horticultural gardens, in which about an acre of ground was graded for

the iris beds. A bank 10 feet wide on the eastern side of the white pine plantation was graded and sodded for a distance of 432 feet. The old lane in the red pine collection has been filled in and is now ready for topsoil. The southern bank of the rose garden was also graded and sodded.

Outside contractors looking for a convenient place to dispose of soil from excavations carted about 1,000 cubic yards into the Garden at their own expense. This contained 250 yards of topsoil, which we used for the new iris and fern beds. On the eastern side of the roadway near the Linnaean Bridge 50 yards were used for grading and 700 yards were placed along the railroad fence north of the Woodlawn Road entrance.

About 500 cubic yards of stone were blasted and removed from the quarry near the museum building and used to construct paths in the iris garden and around the cherry garden shelter.

Drainage

It was necessary to build three catch-basins in order to drain the iris garden, for which we used 74 feet of 4-inch tile pipe, 12 feet of 3-inch tile pipe and 106 feet of 2-inch porous pipe. We rebuilt about 100 feet of the old culvert south of the herbaceous grounds. At the southern end of the serpentine road, 50 feet of 12-inch tile pipe were removed and a culvert 18 inches high, 24 inches wide and 50 feet long was installed.

Water Supply

In order to increase the water pressure in the mansion, 750 feet of a 4-inch water main, with one gate and a branch tee, were laid along the unfinished road from the school garden to the rose garden to make a connection with the 4-inch main that runs to the front of the mansion. To bring about this connection into the mansion 40 feet of 2-inch pipe with two 1½ inch taps were employed. This connection is sufficient to raise water 70 feet from the

ground level, or 10 feet over the roof. The water systems of conservatory range 1, the propagating houses and the comfort stations received necessary repairs.

Paths

A number of paths 10 feet wide and totaling 970 feet in length were completely constructed in the horticultural gardens, and 850 feet were lined and are now ready for stone. Around the drinking fountain in the iris garden a 10-foot path 270 feet long was completed. A 10-foot path 284 feet long was built at the cherry garden shelter, 230 feet of which have been completed. The paths around conservatory ranges 1 and 2 and the path from Bedford Park Boulevard to Mosholu Parkway were resurfaced and rolled.

Buildings

The steps in front of the museum building were rebushed and the pier on the western side was rebuilt. The eastern section of the roof received needed repairs. Several rooms were replastered by the masons. The carpenter repaired the doors, windows and the entrance to the building, and built a partition in the chief clerk's room. The painters replaced all broken windows and painted the new plaster work.

All the brick work of the five boilers in power house 1 was torn down and rebuilt. A Simmons hot-water heater was installed and all necessary repairs were made on the pumps and valves by our steam engineers.

At conservatory range 1, house 1, six steam coils were replaced and in houses 2, 3, 6, and 15 two coils each were replaced. All necessary repairs to the heating system were made by the engineers. The plumber repaired the water pipes, leaders and drainage system. The carpenter repaired the sash bars, sash and doors. The interior of houses 2 and 3 was painted and about 700 panes of broken glass were replaced.

One furnace was relined with fire-brick at power house 2 and all necessary repairs were made to the steam system. The carpenter built a circular ladder for the roof of the display house and repaired sash and doors at conservatory range 2. The painter replaced 130 lights of broken glass. The heating system was repaired wherever necessary.

The water pipe and drainage of the propagating houses were repaired by the plumber and one heating boiler was replaced. Concrete benches were built by the masons in houses 1, 2, 3, and 4 and two concrete tanks for propagating water lilies were constructed in house 4. The sash bars, sash, and doors were repaired by the carpenter. All needed repairs to the water pipe and the drainage were attended to by the plumber and the painter replaced 80 lights of broken glass.

Numerous repairs were made in the mansion and the stable by the carpenter and the plumber.

Grounds

The carpenter completed the cherry garden shelter and built eight rustic benches. He also repaired twenty signs and the rustic fence along the river and near the Woodlawn Road entrance. The plumber erected 750 feet of railing around the rock garden, using as material old steam pipe which had been removed from conservatory range 1; this received two coats of paint and makes an excellent fence. The boundary fence along Bronx Boulevard and one half of the boundary fence along the Fordham University grounds were painted.

For the new fence along Southern Boulevard we built a foundation 515 feet long, 22 inches wide and 30 inches deep. On top of this foundation a stone wall was built 500 feet long and 1 foot high, with 450 feet of coring. We erected twenty piers 20 inches square and 8 feet high, with caps, and two entrance piers 26 inches square and 10 feet high. This is now ready for 450 feet of iron fencing.

Sufficient wood was cut from fallen or dead trees to supply the propagating houses for four months and the mansion for two months by running the gasoline engine for sixteen days. We have continued the uprooting of poison ivy.

From May until September groups of children, averaging about ten parties a week, and consisting of 50 to 2,400 each, visited the Garden. These children were members of public schools and Sunday schools from the Boroughs of Manhattan, Brooklyn and The Bronx. The parties were escorted to the three picnic grounds where they would partake of lunches and enjoy the beauties of the Garden. Special guards were assigned to these grounds daily.

From June until September on Saturdays, Sundays, and holidays, two city officers in civilian clothes were stationed in the Garden. The grounds have been further protected by our own keepers and twelve additional guards selected from the gardeners and laborers. At all other times during the year one city officer was detailed to the Garden. More than 230 arrests were made by officers of the Police Department for violations of park ordinances. These offenders were fined from one to ten dollars each by magistrates sitting in the Eighth District Magistrates' Court. The average number of visitors on Saturdays and Sundays during the summer months was about 50,000, but during July and August this number was greatly increased. Because of the vigilance of our employes, the plantations of the Garden received but little damage.

On account of the large number of admirers visiting the dahlia and gladioli collections daily, it was necessary to detail a guard constantly in the vicinity of these collections. The dahlia collection had to be watched night and day.

Respectfully submitted,

ARTHUR J. CORBETT,

Superintendent of Buildings and Grounds.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1920.

As usual, much time has been taken for personal assistance to those consulting the library, both visitors and members of the Garden Staff, but a limited amount has been available for bibliographic research.

The progress of *North American Flora* has shown some little improvement over the preceding year, but conditions of publication are still far from what might be desired. Volume 24, part 2, appeared in January; but it was not until near the close of the year that parts 4 and 5 of Volume 7 were published. These, as well as part 6 of the same volume, had been in press for many months, but various obstacles prevented their completion. There is much manuscript on hand for future numbers of *North American Flora*.

Of *Addisonia* three numbers were issued during the year. The firm that prepared the colored plates for these numbers did more satisfactory work than any we have had before, but increasing costs made it necessary to change our color-printers again, and this has caused delay in the final number of the fifth volume. Increased cost of production compelled the reduction this year from ten to eight plates per number.

The most noteworthy additions to the Library during the year were the books purchased by the Director-in-Chief in England during his visit last summer; most of these did not arrive in New York until the closing days of the year. A number of them were sumptuous and rare volumes—particularly may be mentioned the seven large folios, with colored plates, of Humboldt, Bonpland, and Kunth's *Genera plantarum*, which were presented to the Library by the Director-in-Chief.

The papers by the Bibliographer published during the year were more numerous than usual, but mostly brief and

unimportant. Perhaps the most worthy of mention were certain biographical sketches contributed to the volume of *American Medical Biographies* edited by Drs. Kelly and Burrage. These related to ten American botanists: T. F. Allen, John Brickell of North Carolina, John Brickell of Georgia, A. W. Chapman, W. P. Gibbons, Thomas Horsfield, Albert Kellogg, P. D. Knieskern, H. P. Sartwell, and George Vasey. These were all written early in 1919, but the book was affected by the delays incident to such work at the present time, and did not make its appearance until September, 1920.

Respectfully submitted,
JOHN HENDLEY BARNHART,
Bibliographer.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1920.

The census of the library which was omitted in 1919 was taken this year and showed a total of 29,950 bound volumes, an increase of 713 over the census of 1918. According to the records 270 books have been received during the past year. Of these there were acquired by purchase 91, by gift 19, and by exchange or deposit 27. Owing to conditions in the book-binding trade we have been able to send but one shipment, and only 133 volumes have been bound.

The principal accessions, with names of donors, have been printed as usual in the *Journal*. There have recently arrived from England over 60 books, including several rare works. Among these is De Tussac's Flora Antillarum in 4 folio volumes with elegant colored plates.

Three new stacks were purchased and installed in the room at the east of the main reading room. Upon these were placed the books relating to geology, palaeobotany, microscopy, pharmacology and agriculture, in part, thus

relieving the congestion in the main stack room and in library extension 1. Shelf labels indicating the main subject headings have been introduced and it is hoped will prove helpful.

There have been added to the catalogue during the past year 1,920 written and typewritten cards, 3,081 cards issued by the Torrey Botanical Club, and 1,202 guide cards, making a total of 6,203. In addition to these, 59 cards have been re-written. The work upon the catalogue has included the supplying of biographical data, about half of the alphabet having been systematically gone through.

The majority of the parts of German periodicals which failed to come during the war have now been supplied and it is probable that the volumes will be in time completed. A number of German societies and institutions have resumed exchange relations. Considerable correspondence has been carried on with French and other publishers who had either temporarily suspended publication or for some other reason had stopped sending their periodicals, and satisfactory explanations have, for the most part, been received.

The following additions and corrections should be made to the periodical list as appended to the report of the Librarian for 1916 (*Bulletin* **9**: 342–363, 449, 450; **10**: 43, 268, 269).

Omit § before the following:

Belgium. Société Royal de Botanique, *Bulletin.*
‡Berlin. Botanischer Garten, *Notizblatt.*
‡Botanisk Tidsskrift.
Brandenburg. Botanischer Verein, *Verhandlungen.*
Bremen. Naturwissenschaftlicher Verein, *Abhandlungen.*
Deutsche Dendrologische Gesellschaft, *Berichte.*
France. Société Dendrologique, *Bulletin.*
Hamburgische Botanische Staatsinstitut, *Berichte.*
Repertorium Novarum Specierum Regni Vegetabilis.

Omit the following:

Amani. Biologisch Landwirtschaftliches Institut, *Der Pflanzer.*
American Journal of Science.
‡American Naturalist.
Bulletin of Pharmacy.

Add the following:

Agricultural Experiment Station, Santo Domingo, *Revista de Agricultura.*
Barcelona. Real Academia de Ciencias y Artes, Barcelona, Spain. *Memorias.*
Ecology, Brooklyn, N. Y.
Flower Grower, Calcium, N. Y.
Geographical Review, New York, N. Y.

Respectfully submitted,
SARAH H. HARLOW,
Librarian.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor of submitting the following report on the economic collections for 1920.

This year, like its predecessor, has been devoted chiefly to the completion of the manuscript and the reading of a portion of the proof of our catalogue of these collections. Nearly all the manuscript has been sent to the printer and the catalogue, in spite of the greatest brevity consistent with the accomplishment of its purpose, will be much larger than was originally expected, making a volume of more than 300 closely printed pages. Its publication during the coming spring is expected.

During the progress of theabove work, about 200 additional specimens have been installed in the cases in time for inclusion in the catalogue. They include additions to nearly all divisions of the museum, those of drugs, foods, and poisonous plants predominating. We now have exhibited in the group of cases immediately at the right of the entrance a representation of most of the poisonous plants of our region. The fleshy edible and poisonous Fungi, specimens of which cannot readily be exhibited

in the preserved state, have been represented by colored pictures supplied by Dr. Murrill. Among the additions of the year, special mention should be made of a fine collection of fruit syrups given by the J. Hungerford Smith Company.

Upon the completion of the catalogue, we should at once take up the work of labeling the very large number of specimens which have accumulated since the printing of labels was discontinued several years since. This work will now be very easy, since the necessary data for the labels will be found printed in the catalogue.

Respectfully submitted,

H. H. Rusby,

Honorary Curator.

REPORT OF THE HONORARY CURATOR OF MOSSES

Dr. N. L. Britton, Director-in-Chief.

Sir: During the year the moss herbarium has received by purchase, collection, or exchange many interesting series of mosses, making notable additions to our collections. These have been published from time to time in the list of accessions in the *Journal.* We have received plants for identification from the National Museum at Washington, Dr. A. Leroy Andrews, of Cornell University, Dr. C. F. Millspaugh, of the Field Museum, and others. Arrangements have been made for the purchase of a set of about 400 specimens from Mrs. W. A. Weymouth, of Hobart, Tasmania, being the duplicates from her husband's collections. Dr. Andrews has determined for us unnamed material of *Bryum* and *Sphagnum*, and Dr. A. W. Evans, of Yale University, has continued the determination of hepatics from our collections. We acknowledge with thanks various comparisons received through Mr. H. N. Dixon from Kew Garden and the British Museum and value his critical notes and determinations of exotic specimens from the Mitten Herbarium.

The collection of lantern slides has been increased by the purchase of 116 colored and 31 uncolored slides, by the gift of 26 colored slides, and by exchange of 6 uncolored ones. Only eight negatives have been added to the collection.

Acting as secretary for the Stokes' Fund and the Wild Flower Preservation Society I have answered letters, distributed literature, and given several lectures to garden clubs in the vicinity of New York.

Respectfully submitted,
ELIZABETH G. BRITTON,
Honorary Curator.

REPORT OF THE HONORARY CURATOR OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows on work in connection with paleobotany at the Garden during the year 1920:

From January 1 to July 15 I was in Washington, D. C., continuing my studies of the fossil flora of Alaska for the U. S. Geological Survey. During the remainder of the year I was in attendance at the Garden regularly one day each week and on other days when circumstances permitted.

Work on the collections of fossil plants recently obtained in Cuba and Porto Rico was prosecuted; preliminary examinations were made of all accessions and the specimens suitably labeled.

Systematic effort was maintained, through correspondence and exchange of publications, to add to the paleobotanical library and to secure all available recent literature on the subject—war conditions, past and present, having seriously interfered with the receipt of publications for several years. About thirty titles, by fifteen different authors, were thus secured and added to the library.

Two small but relatively important accessions to the paleobotanical collections may be specially mentioned,

viz: the collection made during your recent trip to Trinidad, W. I., consisting of about fifteen specimens of fossil plant remains—the first material of its kind, so far as I am aware, ever recorded from the island; and a collection of about forty specimens from the Province of Bahia, Brazil, contributed by arrangement with Professor J. C. Branner, of Leland Standord Jr. University, California, in consideration of a report by me on their general characters. Selected specimens of the species represented have been photographed for critical study and description.

The only changes made in the general collections were the replacement of individual specimens here and there by others better suited for display purposes.

Respectfully submitted,

ARTHUR HOLLICK,

Honorary Curator.

SCHEDULE OF EXPENDITURES DURING THE YEAR 1920

1. CITY MAINTENANCE ACCOUNT

	Budget	Revenue Bond Fund	Total
Salaries, Regular Employees			
Appropriated	$118,154.00	$ 9,018.75	$127,127.75
Expended	117,670.39	8,970.49	126,640.88
Balances	$ 483.61	$ 48.26	$ 531.87
Wages, Temporary Employees			
Appropriated	$ 10,664.00	$ 785.60	$ 11,449.60
Expended	10,664.00	642.00	11,306.00
Balances	$ ———	$ 143.60	$ 143.60
Summary—Personal Service			
Total Appropriated	$128,818.00	$ 9,804.35	$138,622.35
Total Expended	128,334.39	9,612.49	137,946.88
Balances	$ 483.61	$ 191.86	$ 675.47

Forage and Veterinary Supplies	
Appropriated	$ 791.46
Expended	791.46
Fuel Supplies	
Appropriated	$ 22,396.78
Expended	22,391.43
Balance	$ 5.35
Office Supplies	
Appropriated	$ 237.44
Expended	237.44
General Plant Supplies	
Appropriated	$ 949.75
Expended	947.15
Balance	$ 2.60
General Plant Equipment	
Appropriated	$ 1,187.19
Expended	1,187.19
General Plant Materials	
Appropriated	$ 1,899.51
Expended	1,899.51
Balance	———
General Repairs and Replacements	
Appropriated	$ 3,165.85
Expended	3,165.77
Balance	$ .08

Light, Heat and Power			
Appropriated	$ 237.44		
Expended	230.55		
Balance	$ 6.89		
Shoeing and Boarding Horses, including Veterinary Service			
Appropriated	$ 158.29		
Expended	157.65		
Balance	$ .64		
Telephone Service			
Appropriated	$ 158.29		
Expended	151.80		
Balance	$ 6.49		
Summary—Sundry Expenses			
Total appropriated	$ 31,182.00		
Total expended	31,159.95		
Balance	$ 22.05		
Summary—City Maintenance Account			
Total Allowance	$160,000.00	$ 9,804.35	$169,804.35
Total Expended	159,494.34	9,612.49	169,106.83
Balance	$ 505.66	$ 191.86	$ 697.52
Equipment and Supplies		602.96	
Supplies and Materials		1,279.68	$ 1,846.32
Supplies and Materials			
Entrance piers and coping on account		1,000.00	
Stone for fence posts		840.00	
Materials		89.50	
Architects' fees		350.00	
To Reserve for balance due contractor on entrance piers and coping		1,537.50	
	$ 2,200.00	$ 1,802.71	$ *397.29*
Accumulated Income, Russell Sage and Margaret Olivia Sage Memorial Fund			
Gardeners, Drivers and Museum Aids		6,832.94	
Total	$ 18,548.00	$ 18,538.87	$ *9.13*
Transferred from Materials and Contingencies			
Transferred from Materials and Contingencies	150.00		
Transferred from Materials and Contingencies	400.00		
Materials and Contingencies			

2. SPECIAL GARDEN ACCOUNTS

Exploration Fund

Balance from 1919	$	*11.92*	
Refund		8.04	
Balance			$ 19.96

Museum and Herbarium Fund

Balance from 1919		$ *8.62*

PLANT FUND

Balance from 1919	$ 10.39		
Contribution, War Memorial Grove	10.00		
Sale of Hay	355.75		
Total		$	376.14
Expended			159.25
Balance		$	*216.89*

SPECIAL BOOK FUND

Balance from 1919	$	*502.52*
Expended		236.92
Balance	$	*265.60*

GUGGENHEIM GREENHOUSE FUND

Balance from 1919	$	*15.55*

GROUNDS IMPROVEMENT FUND

Balance from 1919	$	*195.26*
Expended		166.28
Balance	$	*28.98*

CONVALESCENT SOLDIERS GARDENING FUND

Balance from 1919			$ *2,244.21*	
Federal Board for Vocational Education				
Fees	$ 5,161.92			
Equipment and Supplies	176.03			
		$ 5,337.95		
Garden School				
Contribution	$ 100.00			
Fees	289.00			
Sales	0.75			
		$ 389.75		
Total			$	7,971.91
Expended				
Salaries		$ 4,311.38		
Labor		1,787.75		
Equipment and Supplies		602.96		
Total			$	6,702.09
Balance			$	*1,269.82*

CHERRY GARDEN SHELTER FUND

Balance from 1919	$	*396.99*	
Contribution		1,449.33	
Total		$	1,846.32
Expended			
Salaries	$	566.64	
Supplies and Materials		1,279.68	$ 1,846.32

Reserve Fund

General Maintenance		
Appropriated	$ 8,216.00	
Expended, Fuel	1,816.66	
Balance		$ *6,399.34*
Salaries		
Appropriated	$ 6,784.00	
Expended	2,729.52	
Balance		$ *4,054.48*
Supplies and Materials		
Appropriated (transferred from Income of Sage Fund)	$ 12,150.00	
Expended, supplies, materials, etc.	12,101.06	
Balance	$ *48.94*	
Total Appropriations		$ 27,150.00
Total Expended		16,647.24
Balance		$ *10,502.76*

Special Development Fund

Contributions		$ 13,485.00
Expended		
Iris Garden and paths	$ 5,711.54	
Railings	708.28	
Books and bookcases	2,276.57	
Museum and Herbarium cases	242.67	
New Guidebook	433.24	
Miscellaneous	66.65	
To Reserve for		
Herbarium Cases	1,110.00	
Lily Bulbs	400.00	$ 10,948.95
Balance		$ *2,536.05*

Mary J. Kingsland Bequest

Appropriated for Fence on Southern Boulevard		$ 5,000.00
Expended		
Mason work	$ 680.00	
Labor	460.80	
Entrance piers and coping on account	1,000.00	
Stone for fence posts	840.00	
Materials	89.50	
Architects' fees	350.00	
To Reserve for balance due contractor on entrance piers and coping	1,537.50	
Total	$	4,957.80
Balance	$	*42.20*

3. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balance*
Income of Science and Education Fund			
Herbarium		$ 225.61	
Lectures		1,326.00	
Laboratories		420.52	
Museum		1,187.71	
Photography		220.14	
Exporation		613.87	
	$ 4,000.00	$ 3,993.85	$ *6.15*
Income of Darius O. Mills Fund			
Books and Binding		$ 337.31	
Investigation at other Institutions		219.48	
Scientific Supplies		1,245.92	
	$ 2,200.00	$ 1,802.71	$ *397.29*
Accumulated Income of Henry Iden Fund			
Books	$ 900.00	$ 684.99	$ *215.01*
Income of William R. Sands Fund			
From Income	$ 200.00		
From Horticultural Society of New York	5.48		
Horticultural Prizes	$ 205.48	$ 203.50	$ *1.98*
Accumulated Income of Olivia E. and Caroline Phelps Stokes Fund			
Preservation of Native Plants	$ 250.00	$ 2.69	$ *247.31*
Accumulated Income of Students' Research Fund			
Aid for Students' Research	$ 500.00		$ *500.00*
Income of David Lydig Fund			
Publications	$ 4,000.00	$ 3,978.84	$ *21.16*
Income of Addison Brown Fund			
Preparation, Publication, and Distribution of Addisonia	$ 3,600.00	$ 3,594.32	$ *5.68*
Income of John Innes Kane Fund			
Plants for Grounds and Greenhouses	$ 500.00	$ 424.27	$ *75.73*
Income of Maria DeWitt Jesup Fund			
Books		$ 231.88	
Specimens		$ 747.13	
Total	$ 1,000.00	$ 979.01	$ *20.99*
Accumulated Income of Charles Budd Robinson Fund			
For Aiding Exploration	$ 80.00		$ *80.00*

Accumulated Income Russell Sage and Margaret Olivia Sage Memorial Fund			
Salaries			
Individual Accounts		$ 9,005.93	
Gardeners, Drivers and Museum Aids		6,832.94	
Transferred to Labor		2,700.00	
Total	$ 18,548.00	$ 18,538.87	$ *9.13*
Labor			
Appropriated	$ 3,000.00		
Transferred from Salaries	2,700.00		
Transferred from Construction	300.00		
Transferred from Reimbursement Account	1,425.00		
Mason Work		$ 3,050.00	
Weekly Payrolls		2,953.20	
Guard Duty and Overtime		1,412.88	
	$ 7,425.00	$ 7,416.08	$ *8.92*
Construction			
Transferred to Labor		$ 300.00	
Transferred to General Supplies		5,600.00	
Colored Prospectives		1,575.00	
	$ 7,500.00	$ 7,475.00	$ *25.00*
Horticultural Prizes			
Transferred from Materials and Contingencies	$ 450.00	$ 430.00	$ *20.00*
Publication			
Transferred from Reimbursement Account	$ 4,000.00	$ 3,613.96	$ *386.04*
Coal			
Transferred from Reimbursement Account	$ 4,450.00		
Transferred from Materials and Contingencies	150.00		
	$ 4,600.00	$ 4,599.54	$ *0.46*
General Supplies			
Transferred from Construction	$ 5,600.00		
Transferred from Materials and Contingencies	400.00		
Transferred from Reimbursement Account	2,700.00		
	$ 8,700.00	$ 8,698.25	$ *1.75*

Materials and Contingencies			
Transferred to Horticultural Prizes.		$ 450.00	
Transferred to General Supplies....		400.00	
Transferred to Coal.....		150.00	
Expended.....		1,647.43	
	$ 3,000.00	$ 2,647.43	$ 352.57
Reimbursement Account			
Transferred to Reserve Fund.....		$ 12,150.00	
Transferred to Publications		4,000.00	
Transferred to Coal..... ..		4,450.00	
Transferred to Labor..... .		1,425.00	
Transferred to General Supplies....		2,700.00	
	$ 54,378.00	$ 24,725.00	$ 29,653.00
Summary			
Transferred to Reserve Fund.....		$ 12,150.00	
Expended.....		43,819.13	
	$ 86,426.00	$ 55,969.13	$ 30,456.87

4. GENERAL INCOME ACCOUNT

Insurance			
Museum Specimens and Books		$ 366.60	
Boilers and Elevator.....		286.10	
Horses and Wagons.....		10.00	
	$ 700.00	$ 662.70	$ 37.30
Supplies (including Circulars for Members)	$ 800.00	$ 799.79	$ 0.21
Entertainment of Guests and Meetings of Members			
Refreshments.....		$ 588.00	
Hire of Touring Cars.....		240.25	
Travelling Expenses.		57.64	
Printing.....		255.00	
	$ 1,400.00	$ 1,140.89	$ 259.11
Assistance for Treasurer.... .. .	$ 1,080.00	$ 740.00	$ 340.00
Salaries.....	$ 18,870.00	$ 18,289.91	$ 580.09
Total..	$ 22,850.00	$ 21,633.29	$ 1,216.71

5. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts..	$ 38,617.35
Special Income Accounts.	59,283.31
General Income Account..... .	21,633.29
Total.....	$119,533.95

6. BOARD ROOM FUND

January 1, 1920. Balance—Cash		$	*104.18*
Gross Receipts, January to December	$ 541.01		
Less—Credited to Garden Funds	*6.50*		
Total Net Receipts	$ 534.51	$	534.51
		$	638.69
Disbursements			
Supplies	$ 354.59		
Contingencies	78.72		
	$ 433.31	$	433.31
December 31, 1920. Balance—Cash		$	*205.38*
		$	*205.38*

Respectfully submitted,
WALTER S. GROESBECK,
Bookkeeper.

E. and O. E.
NEW YORK, January 10, 1921.

DIRECTOR-IN-CHIEF'S ACCOUNT FOR THE YEAR 1920

ROOM 318, GRAND CENTRAL TERMINAL
New York, May 19th, 1921

MR. ROBERT W. DEFOREST,
Chairman Finance Committee, New York Botanical Garden,
30 Broad Street, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and twenty (1920), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in the auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the then Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

Respectfully submitted,
A. W. STONE,
Special Auditor.

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

(*Received and ordered printed Jan. 10, 1921*)

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: The Scientific Directors have held their regular meetings throughout the year. We have seriously missed our colleague Doctor Lee, who has been absent in Europe. Among topics receiving special attention are plans for pushing work in botanical exploration and for developing experimental research on problems relating to soils and plant diseases.

There is an increasing demand through the Torrey Botanical Club for a more intensive study of the native plants of the local floral region from the standpoint of variation, geographic distribution, hybridization, etc., and it is hoped we may be able to make further provision at the garden for storing and studying the collections resulting from such work.

The report of the Director-in-Chief gives a full account of the educational, research and other scientific activities of the garden during the year and they need not be further summarized here.

Respectfully submitted,

R. A. HARPER,

Chairman of the Scientific Directors.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS AND MEMBERS FOR THE YEAR 1920

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 169. The number of annual members is now 1,090; life members 133; sustaining members 13; fellowship members 2.

Of these 32 are now in arrears for dues for 1920, 11 for dues for 1919 and 1920, 6 for dues for 1918, 1919 and 1920.

Dues have been collected to the amount of $11,240.

One person has qualified as a life member by the payment of $250. These sums have been transmitted to the treasurer.

A complete list of all classes of members to date is herewith submitted.

Benefactors

*Mrs. Fanny Bridgham
*Hon. Addison Brown,
*Andrew Carnegie,
Columbia University,
*Hon. Chas. P. Daly,
Daniel Guggenheim,
Murry Guggenheim,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
*Mrs. Russell Sage,
*Cornelius Vanderbilt.

Patrons

Oakes Ames,
*Miss Catherine A. Bliss,
Dr. N. L. Britton,
*Hon. Addison Brown,
*Andrew Carnegie,
*Mrs. George Whitfield Collord,
*Mrs. Louisa Combe
*James M. Constable,
*William E. Dodge,
James B. Ford,
George J. Gould,
Edward S. Harkness,
*Mrs. Esther Herrman,
Archer M. Huntington,
*Henry Iden,
Mrs. John Innes Kane,
*John Stewart Kennedy,
*Mrs. Mary J. Kingsland,
*J. Pierpont Morgan, Sr.,
*Oswald Ottendorfer,

*Lowell M. Palmer,
William Rockefeller,
*William R. Sands,
*William C. Schermerhorn,
*James A. Scrymser,
Mrs. Finley J. Shepard,
*Samuel Sloan,
Mrs. Frederick F. Thompson,
*W. K. Vanderbilt,
Mrs. Antoinette Eno Wood.

Fellows for Life

Edward D. Adams,
George F. Baker,
Miss Elizabeth Billings,
Mrs. W. Bayard Cutting,
Dr. Robert W. de Forest,
Cleveland H. Dodge,
James B. Ford,
Daniel Guggenheim,
Murry Guggenheim,
S. R. Guggenheim,
Mrs. John Stewart Kennedy,
Edward V. Z. Lane,
Mrs. Frederic S. Lee,
Ogden Mills,
Mrs. John A. Roebling,
Mortimer L. Schiff,
Miss Olivia E. Phelps Stokes,
Charles G. Thompson,
Louis C. Tiffany,
Tiffany & Company.

Life Members

Edward D. Adams,
Dr. Felix Adler,
Mrs. James Herman Aldrich,
J. Sherlock Andrews,
Dr. S. T. Armstrong,
Edward W. C. Arnold,
Mrs. H. D. Auchincloss,
Samuel P. Avery,
Samuel D. Babcock,
Dr. John Hendley Barnhart,
George D. Barron,
Aurel Batonyi,
Gustav Baumann,
Samuel R. Betts,
William G. Bibb,
Miss Elizabeth Billings,
J. O. Bloss,
George Blumenthal,
G. T. Bonner,
Mrs. Addison Brown,
J. Hull Browning,
T. Morris Carnegie,
Frank R. Chambers,
Hugh J. Chisholm,
Hugh J. Chisholm, Jr.,
Geo. C. Clark,
Banyer Clarkson,
Dr. James B. Clemens,
Wm F. Cochran,
William Colgate,
Miss Georgette T. A. Collier,
W. E. Connor,
Mrs. F. A. Constable,
Theodore Cooper,
Zenas Crane,
R. N. Cranford,
Melville C. Day,
Charles Deering,
Mrs. John Ross Delafield,
Maturin L. Delafield,

W. B. Dickerman,
Miss Josephine W. Drexel,
Miss Ethel DuBois,
Miss Katharine DuBois,
Wm. A. DuBois,
Geo. E. Dunscombe,
Thomas Dwyer,
Newbold Edgar,
George Ehret,
Ambrose K. Ely,
Edward J. Farrell,
Mrs. H. J. Fisher,
Andrew Fletcher,
Chas. R. Flint,
Eugene G. Foster,
Mrs. John French,
Mrs. Theodore Kane Gibbs,
James J. Goodwin,
Daniel Guggenheim,
Bernard G. Gunther,
Franklin L. Gunther,
Chas. J. Harrah,
Dr. Louis Haupt,
R. Somers Hayes,
Archer M. Huntington,
Frank D. Hurtt,
James H. Hyde,
Mrs. Columbus O'D. Iselin,
Theo. F. Jackson,
Dr. Walter B. James,
Miss Annie B. Jennings,
Mrs. David J. Kelley,
Nathaniel T. Kidder,
William M. Kingsland,
H. R. Kunhardt,
W. B. Kunhardt,
Charles Lanier,
W. V. Lawrence,
Meyer H. Lehman,
Mrs. Geo. Lewis,
Joseph Loth,
Wm. H. Macy, Jr.,
Mrs. Wm. H. Macy, Jr.,
Louis Marshall,
Edgar L. Marston,
William J. Matheson,
C. W. McAlpin,
Guy R. McLane,
Emerson McMillin,
Dr. Geo. N. Miller,
A. G. Mills,
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Gordon Norrie,
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Mortimer L. Schiff,
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Robert M. Thompson,

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Dr. W. Seward Webb,
Hon. Geo. Peabody Wetmore,
John D. Wing,
Mrs. Anna Woerishoffer.

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E. A. Richard.

Sustaining Members

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Miss Mary T. Bryce,
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John Greenough,
Mrs. McDougall Hawkes,
O. H. Kahn,
Edgar L. Marston,
George Grant Mason,
Arthur M. Mitchell,
Wm. Church Osborn,
William H. Porter,
William R. Stewart,
Charles Strauss.

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John Achelis,
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Henry S. Adams,
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Mrs. John E. Alexandre,
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Philip Allen,
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John W. Auchincloss,
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Robert Behr,
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Louis V. Bell,
August Belmont,
J. Philip Benkard,
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Isaac J. Bernheim,
Chas. L. Bernheimer,
Miss Rosie Bernheimer,
Theodore Berstein,
Philip Berolzheimer,
S. Reading Betron,
Edward J. Berwind,
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Mrs. Sylvan Bier,
Abraham Bijur,
Nathan I. Bijur,
Samuel H. Bijur,
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Louis Boury,
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John McE. Bowman,
Frank Brainerd,
Mrs. E. N. Breitung,
George S. Brewster,
Mrs. Benjamin Brewster,
Hans V. Briesen,
John R. Brinley,
Mrs. Willard C. Brinton,
Jno. I. D. Bristol,
Miss H. Louise Britton,

Richard H. Britton,
Dr. Edward B. Bronson,
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Edwin H. Brown,
M. Bayard Brown,
Vernon C. Brown,
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Prof. Otis W. Caldwell,
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Henry L. Cammann,
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Miss Elizabeth Chamberlain,
O. E. Chaney,
Miss Maria Bowen Chapin,
John Jay Chapman,
Jose Edwards Chaves,
Dr. Charles H. Chetwood,
John H. Child,
B. Ogden Chisolm,
Geo. E. Chisolm,
Mrs. Joseph H. Choate,
Miss Mabel Choate,
Wm. G. Choate,
Mrs. Helen L. Chubb,
Percy Chubb,
Chas. T. Church,
Richard N. L. Church,
John Claflin,
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Miss Emily Vernon Clark,
F. Ambrose Clark,
Hon. W. A. Clark,
William Clark,
E. A. S. Clarke,
Lewis L. Clarke,
Albert Clayburgh,
Edward B. Close,
Miss Frances H. Close,
Wm. P. Clyde,
G. D. Cochran,
Miss Mary T. Cockcroft,
C. A. Coffin,
Edmund Coffin,
E. W. Coggeshall,
William N. Cohen,
William W. Cohen,
J. L. Coker,

Mrs. Rufus Cole,
Charles B. Colebrook,
Mrs. Lathrop Colgate,
William Colgate,
Barron G. Collier,
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Samuel P. Colt,
Miss Mary Compton,
T. G. Condon,
Hermann Conheim,
Roland R. Conklin,
Joseph Conners,
J. N. Conyngham,
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William Crawford,
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W. T. Crocker,
James W. Cromwell,
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Mrs. E. B. Currier,
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G. Warrington Curtis,
R. Fulton Cutting,
Mrs. Barton Cuyler,
Miss Eleanor De Graff Cuyler,
Jean De Saint Cyr,

Mrs. Chester Dale,
Frederic A. Dallett,
D. S. Dark,
Mrs. Ira Davenport,
De Witt A. Davidson,
J. Clarence Davies,
Mrs. Thomas B. Davis,
Alvah Davison,
Mrs. Henry P. Davison,
Clarence S. Day,
Mrs. William Harrison Day,
Henry Dazien,
Henry L. de Forest,
Dr. Robert W. de Forest,
Mrs. Robert W. de Forest,
John F. Degener, Jr.,
Mrs. Carlos de Heredia,
Moreau Delano,
William Adams Delano,
William C. De Lanoy,
Countess de Laugier-Villars,
John B. Dennis,
Rev. H. M. Denslow,
Walter D. Despard,
Julian F. Detmer,
Lee Deutsch,
William G. De Witt,
J. Henry Dick,
Geo. H. Diehl,
Chas. F. Dieterich,
Miss Josephine H. Dill,
Miss Mary A. Dill,
Mrs. Alfred P. Dix,
Miss Gertrude Dodd,
Cleveland H. Dodge,
Francis P. Dodge,
L. W. Dommerich,
Otto L. Dommerich,
Charles Doscher,
Henry Doscher,

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Mrs. James Douglas,
Walter Douglas,
Alfred Douglass,
W. E. Dowd, Jr.,
Tracy Dows,
Mrs. B. F. Drakenfeld,
J. R. Drexel,
Isaac W. Drummond,
Mrs. Matthew B. Dubois,
F. L. Du Bosque,
Mrs. John P. Duncan,
Ralph Wurts Dundas,
Dr. Edward K. Dunham,
H. F. du Pont,
Mrs. T. Coleman du Pont,
William du Pont,
E. G. Duvall,
John E. Dwight,
Mrs. Winthrop Dwight,
R. W. Earle,
Mrs. Frederick H. Eaton,
C. R. Ebert,
Mrs. Charles N. Edge,
Thomas C. Edmonds,
Mrs. J. S. Ehrich,
Mrs. Ernest Ehrmann,
Karl Eilers,
Henry G. Eilshemius,
August Eimer,
Monroe Einstein,
William Einstein,
Miss Kate Eisig,
Howard Elliott,
Mrs. James W. Ellsworth,
Mrs. Walter Emmerich,
Miss Lydia F. Emmett,
Robert Temple Emmett,
Mrs. Arthur B. Emmons,
R. Erbsloh,
Albert J. Erdmann,
Abraham Erlanger,
Miss Katherine V. Erving,
Henry Esberg,
Louis Ettlinger,
S. M. Evans,
A. W. Evarts,
Mrs. Ernesto Fabbri,
Eberhard Faber,
Harris Fahnestock,
Arthur S. Fairchild,
Chas. S. Fairchild,
Samuel W. Fairchild,
Percival Farquhar,
Mrs. Max Farrand,
James C. Farrell,
Louis Ferguson.
William C. Ferguson,
Frank H. Filley,
Frederick T. Fisher,
Pliny Fisk,
Mrs. Montague Flagg,
Harry Harkness Flagler,
Mrs. Albert Flake,
Nathan Fleischer,
Fred T. Fleitmann,
Edward H. Floyd-Jones,
L. G. Forbes,
Frank B. Foster,
Scott Foster,
Robert L. Fowler, Jr.,
Mrs. M. J. Fox,
Mrs. William Fox,
David J. Frankel,
Mrs. P. A. S. Franklin,
R. A. Franks,
Miss Jane K. Fraser,
Miss S. Grace Fraser,
A. S. Frissell,
John W. Frothingham,

John H. Fry,
W. W. Fuller,
E. A. Funke,
William H. F. Gade,
Eugenio Galban,
Albert Gallatin,
Geo. F. Gantz,
Francis P. Garvin,
Mrs. Walter Geer,
R. W. Gibson,
Prof. William J. Gies,
Mrs. William J. Gies,
J. Waldron Gillespie,
Robert McM. Gillespie,
Mrs. E. D. Godfrey,
Mrs. Mary R. Goelet,
Julius Goldman,
Abraham L. Goldstone,
Philip J. Goodhart,
Miss Clara J. Gordon,
Chas. Gotthelf,
Chas. A. Gould,
Edwin Gould,
Mrs. W. R. Grace,
Joseph W. Grant,
U. S. Grant, 4th,
B. Greeff, Jr.,
William G. Grieb,
Hon. Anthony J. Griffin,
Charles E. Griffin,
W. V. Griffin,
Miss Margarette E. Griffith,
Miss Susan D. Griffith,
E. Morgan Grinnell,
George Bird Grinnell,
Mrs. Chester Griswold, Sr.,
George V. Gross,
William C. Gruner,
A. M. Guinzburg,
Mrs. Gurnee,
Mrs. C. S. Guthrie,
William D. Guthrie,
Miss Edith Haas,
John A. Hadden, Jr.,
Hon. Ernest Hall,
Harrison H. Hallett,
Wm. Halls, Jr.,
Mrs. Charles W. Halsey,
Wm. Hamann,
L. Gordon Hamersley,
Miss Elizabeth S. Hamilton,
Mrs. William P. Hamilton,
Ferdinand Hansen,
J. Montgomery Hare,
E. S. Harkness,
Mrs. Stephen V. Harkness,
Miss Josephine T. Harriot,
George A. Harris,
J. Amory Haskell,
Jacob Hasslacher,
Dr. Louis Hauswirth,
T. A. Havemeyer,
J. Woodward Haven,
Carroll Hayes,
Miss Caroline C. Haynes,
David S. Hays,
Mrs. R. G. Hazard,
Mrs. W. R. Hearst,
Wm. W. Heaton,
David Helier,
Mrs. George A. Helme,
Hancke Hencken,
Chas. Henderson,
Mrs. E. C. Henderson,
Harmon W. Hendricks,
Philip W. Henry,
Mrs. A. Barton Hepburn,
B. F. Hermann,
W. L. Hernstadt,
Mrs. E. D. Lee Herreshoff,

George B. Herzig,
Samuel A. Herzog,
H. H. Hewitt,
Henry Hicks,
Mrs. James J. Higginson,
Hugh Hill,
Mrs. Robert Hill,
Mrs. Samuel N. Hinckley,
B. Hochschild,
Richard M. Hoe,
Mrs. Richard March Hoe,
Mrs. Robert Hoe,
Miss Mary U. Hoffman,
Bernhard Hoffmann,
Mrs. Bernhard Hoffmann,
Mrs. Edward Holbrook,
John Swift Holbrook,
Dean Hawley Holden,
Edwin T. Holmes,
A. Holzman,
Elkan Holzman,
Mrs. Elon Huntington Hooker,
Chas. H. Hoole,
Ernest Hopkinson,
Frederick B. House,
C. J. Housman,
Richard F. Howe,
M. D. Howell,
Mrs. Henry E. Howland,
John Sherman Hoyt,
Miss Rosina S. Hoyt,
Theodore R. Hoyt,
Miss V. S. Hoyt,
Walter C. Hubbard,
Mrs. Anna Huber,
Conrad Hubert,
Mrs. Thomas Hunt,
Mrs. H. E. Huntington,
Mrs. R. P. Huntington,
Dr. Lee M. Hurd,
H. D. Hutchins,
Frank DeK. Huyler,
Mrs. Clarence M. Hyde,
Courtney Hyde,
Henry St. John Hyde,
Edwin W. Inslee,
Adrian Iselin, Jr.,
C. Oliver Iselin,
Miss Georgine Iselin,
Lewis Iselin,
William E. Iselin,
Mrs. William E. Iselin,
Miss Flora E. Isham,
A. C. Israel,
Samuel K. Jacobs,
John S. Jacobus,
A. C. James,
Mrs. Arthur Curtis James,
Dr. Robert C. James,
Mrs. Wortham James,
E. C. Jameson,
Mrs. Robert A. Jamison,
Mrs. Alfred Jaretzki,
Alfred W. Jenkins,
O. G. Jennings,
Walter B. Jennings,
George S. Jephson,
Gilbert H. Johnson,
Francis C. Jones,
Rodney Wilcox Jones,
Mrs. Townsend Jones,
Louis M. Josepthal,
Karl Jungbluth,
Henry M. Kahle,
Felix E. Kahn,
Louis Kahn,
Mrs. Delancey Kane,
Mrs. H. F. Kean,
Frank Browne Keech,
Henry F. Keil,

William W. Kelchner,
Prof. J. F. Kemp,
Mrs.H.VanRensselaerKennedy,
Mrs. John S. Kennedy,
David Keppel,
Rudolph Keppler,
W. M. Kern,
John B. Kerr,
Mrs. Charles W. Keyes,
Emil L. Kieger,
S. E. Kilner,
Darwin P. Kingsley,
Morris Kinney,
Warren Kinney,
W. Ruloff Kip,
William B. Kirkham,
Mrs. Gustav E. Kissel,
Mrs. Charles P. Kling,
E. C. Klipstein,
Roland F. Knoedler,
Chas. Kohlman,
Marion B. Kohlman,
Alex. Konta,
Dr. George F. Kunz,
A. H. Kursheedt,
Anthony R. Kuser,
Adolf Kuttroff,
Stanley V. La Dow,
Mrs. Samuel W. Lambert,
Mrs. J. H. Lancashire,
Francis G. Landon,
Edward V. Z. Lane,
Woodbury Langdon,
Mrs. Jacob Langeloth,
Mrs. John J. Lapham,
Lewis H. Lapham,
Montgomery La Roche,
Henry G. F. Lauten,
Mrs. Amory A. Lawrence,
John Burling Lawrence,
Henry Goddard Leach,
Lederle Antitoxin Laboratories,
Prof. Frederic S. Lee,
Marshall C. Lefferts,
George Legg,
James M. Lehmaier,
S. M. Lehman,
Wm. H. Leupp,
Edmund J. Levine,
G. Levor,
Louis S. Levy,
Montgomery H. Lewis,
Adolph Lewisohn,
Miss Alice Lewisohn,
Paul Lichtenstein,
E. K. Lincoln,
Mrs. Frederic W. Lincoln,
Frederick J. Lisman,
Lucius N. Littauer,
Siegfried Littauer,
Mrs. John R. Livermore,
Miss Anna P. Livingston,
Mrs. Francis G. Lloyd,
Mrs. William C. Lobenstine,
Mrs. I. Ferris Lockwood,
Mrs. Frank J. Logan,
Russell H. Loines,
Mrs. Matthew M. Looram,
Manuel Lopez,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Mrs. Seth Low,
August Lueder,
Walther Luttgen,
William M. Lybrand,
J. M. Richardson Lyeth,
S. Ma,
Dr. John T. Mac Curdy,
C. K. MacFadden,

Clarence H. Mackay,
Kenneth K. Mackenzie,
Mrs. Charles F. MacLean,
Malcolm MacMartin,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
L. William Malone,
J. G. C. Mantle,
Miss Delia W. Marble,
John Markle,
Mrs. John Markle,
Dr. J. W. Markoe,
Alfred E. Marling,
Otto Maron,
Mrs. Henry Marquand,
Edwin S. Marston,
R. W. Martin,
Dr. Walton Martin,
William J. Matheson,
George O. May,
Harry Mayer,
Mrs. R. de L. Mayer,
Dr. D. H. McAlpin,
Geo. L. McAlpin,
George McAneny,
Mrs. Alfred McEwen,
Edward A. McIlhenny,
Henry P. McKenney,
John A. McKim,
W. A. McLaren,
Mrs. James McLean,
Edward F. McManus,
William McNair,
B. Frank Mebane,
Morton H. Meinhard,
Dr. Walter Mendleson,
Henry H. Merriam,
John L. Merrill,
William F. Meschenmoser,
Manton B. Metcalfe,
Herman A. Metz,
Eugene Meyer, Jr.,
Harry J. Meyer,
John G. Milburn,
Dr. Adelaide Mills,
Alex. S. Mitchell,
Mrs. John Murray Mitchell,
H. de La Montagne,
C. D. Montague,
Mrs. H. E. Montgomery,
Barrington Moore,
Clement Moore,
J. C. Moore,
Miss Katherine T. Moore,
Mrs. Paul Moore,
Russell W. Moore,
Victor Morawetz,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P Morgan, Jr.,
Mrs. Pierpont Morgan,
Wm. Fellows Morgan,
Mrs. Dave Hennen Morris,
Dwight W. Morrow,
Henry C. Mott,
Mrs. John B. Mott,
Eric Muelberger,
Frank J. Muhlfeld,
Edwin H. Mulford,
Carl Muller,
John P. Munn,
Frank A. Munsey,
G. M. P. Murphy,
Fred A. Muschenheim,
William S. Myers,
Mrs. Joseph G. Myerson,
Mme. Elie Nadelman,

Edward J. Nally,
National Association, Boards of Pharmacy,
A. G. Nesbitt,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
William H. Nichols,
Wm. Nilsson,
Mrs. E. L. Breese Norrie,
George Notman,
Howard Notman,
Miss Dorothy Oak,
Percy J. O'Brien,
Mrs. Adolph Obrig,
Adolph S. Ochs,
John Offerman,
Mrs. Ponsonby Ogle,
P. M. Ohmeis,
E. E. Olcott,
Miss Mary Olcott,
Elam Ward Olney,
Robert Olyphant,
Mrs. Emerson Opdycke,
Mrs. Wm. Openhym,
J. Oppenheim,
John B. O'Reilly,
William C. Orr,
Prof. Henry F. Osborn,
Mrs. William Church Osborn,
Homer S. Pace,
Miss Elizabeth H. Packard,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Mrs. Edgerton Parsons,
Miss Gertrude Parsons,
Mrs. Henry Parsons,
T. H. Hoge Patterson,
Mrs. Frederick Pearson,
Charles E. Peck,
Dr. Charles H. Peck,
William Halsey Peck,
Mrs. Wheeler H. Peckham,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
B. Henry Pelzer,
Edmund Penfold,
Miss Hattie W. Perkins,
Louis H. Perlman,
Samuel T. Peters,
Mrs. Theodore Peters,
W. R. Peters,
Carl Schurz Petrasch,
Curt G. Pfeiffer,
Walter Pforzheimer,
Michael F Phelan,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Gottfried Piel,
Henry Clay Pierce,
Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
John Platt,
Edward Plaut,
Gilbert M. Plympton,
Miss R. A. Polhemus,
Miss Florence L. Pond,
Chas. Lane Poor,
Mrs. James Harper Poor,
James E. Pope,

Alexander J. Porter,
Mrs. Henry Kirke Porter,
Abram S. Post,
Miss Blanche Potter,
Mrs. Frank H. Potter,
Frederick Potter,
Fuller Potter,
Mrs. George D. Pratt,
Mrs. Herbert Lee Pratt,
John Pratt
John T. Pratt,
Samuel Pratt,
Mrs. L. B. Preston,
Clinton B. Price,
Miss Cornelia Prime,
Thomas R. Proctor,
Mrs. Kate Davis Pulitzer,
H. St. Clair Putnam,
Miss Eva C. Putney,
Percy R. Pyne,'
Charles F. Quincy,
Stanley Ranger,
G. B. Raymond,
George W. Raynes,
Mrs. William A. Read,
Robert C. Ream,
Miss Emily Redmond,
John Reid,
Chas. Remsen,
William Rennult,
Samuel W. Reyburn,
Mrs. E. S. Reynal,
Miss Elvine Richard,
Oscar L. Richard,
Eben Richards,
E. O. Richards,
Max Richter,
Mrs. Robert Ridgway,
Wm. J. Riker,
Dr. A. I. Ringer,
Dr. Wm. C. Rives,
Miss Emeline Roach,
Mrs. Charles H. Roberts,
G. Theo. Roberts,
Miss G. Van B. Roberts,
Miss Jennette Robertson,
Louis J. Robertson,
Andrew J. Robinson,
Mrs. John D. Rockefeller, Jr.
William G. Rockefeller,
Nash Rockwood,
Albert J. Roe,
Edward L. Rogers,
John Roger,
G. Vernor Rogers,
Hubert E. Rogers,
A. J. Rolle,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Henry C. Ross,
Jacob Rossbach,
Peter W. Rouss,
W. A. Rowan,
C. H. Ruddock,
Louis Ruhl,
Justus Ruperti,
Jacob Ruppert,
Frederick K. Rupprecht,
Miss M. L. Russell,
John Barry Ryan,
Arthur Ryle,
Miss Julia Ryle,
Harry Sachs,
Samuel Sachs,
Clarence Sackett,
Mrs. Walter J. Salmon,
Mitchell Samuels,
Philip C. Samuels,
Mrs. B. Aymar Sands,

H. Sanhagen,
F. A. Sarg,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
Mrs. Thomas E. Satterthwaite,
Oliver H. Sawyer,
Hermann Schaaf,
Fred'k Müller Schall,
Jacob Schapiro,
John Scheepers,
Anton Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Charles A. Schieren,
Gustave H. Schiff,
C. P. Schlicke,
Miss Jane E. Schmelzel,
Fedor Schmidt,
D. Schnakenberg,
Henrich Schniewind, Jr.,
Carl Schoen,
W. D. Scholle,
Louis B. Schram,
Rudolph Schreiber,
Richard Schuster,
B. Schutz,
C. M. Schwab,
Gustav Schwab, Jr.,
Frederick Schwed,
Walter Scott,
Miss Grace Scoville,
Robert Scoville,
The Scoville School,
Mrs. Arthur H. Scribner,
Edward M. Scudder,
Alonzo B. See,
Prof. Edwin R. A. Seligman,
Mrs. Isaac N. Seligman,
Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,
Alfred Seton,
Mrs. William F. Sheehan,
Dr. William H. Sheldon,
Finley J. Shepard,
David Shiman,
S. W. Shipway,
Hiram W. Sibley,
Mrs. J. Siegel,
H. L. Simmons,
Alfred L. Simon,
Franklin Simon,
Robert E. Simon,
Theodore A. Simon,
John W. Simpson,
Francis Louis Slade,
Ralph E. Slaven,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Charles R. Smith,
Miss Fanny A. Smith,
James B. Smith,
Pierre J. Smith,
B. E. Smythe,
E. G. Snow,
Phineas Sondheim,
B. Souto,
William M. Spackman,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
Mrs. B. G. Spiegelberg,
Dr. Edward H. Squibb,
J. R. Stanton,
Mrs. Mary P. Eno Steffanson,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,

Roderick Stephens,
Benjamin Stern,
J. Ernest Stern,
Edward R. Stettinius,
Sereno Stetson,
Mrs. Byam K. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Lispenard Stewart,
Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
Mrs. James Stokes,
Alfred W. Stone,
Mrs. Willard Straight,
Mrs. C. I. Stralem,
H. Grant Straus,
Mrs. Nathan Straus, Jr.,
Roger W. Straus,
Albert Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
W. H. Strawn,
Edward S. Strobhar,
Dr. George T. Strodl,
Mrs. Gustaf Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Richard A. Strong,
Mrs. Theron G. Strong,
Joseph Stroock,
Louis S. Stroock,
Duncan Struthers,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Miss Victoria F. Sturmer,
Mrs. James Sullivan,
D. R. Szakvary,
Miss Mary Taber,
Henry W. Taft,
E. T. H. Talmage,
C. A. Tatum,
Henry R. Taylor,
Dr. Richard A. Taylor,
W. A. Taylor,
H. L. Terrell,
Charles T. Terry,
Mrs. John T. Terry,
Miss M. J. Thayer,
Mrs. Hector W. Thomas,
Mrs. Howard L. Thomas,
Percival Thomas,
Loren Ogden Thompson,
L. S. Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Samuel Thorne, Jr.,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
Dr. Walter Timme,
James Timpson,
Rev. E. P. Tivnan, S. J.,
Mrs. Margaret T. Tjader,
J. Kennedy Tod,
Mrs. John B. Trevor,
A. F. Troescher,
John Trounstine,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Edward Turnbull,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
Mrs. Alice B. Tweedy,
E. S. Twining,
Lucien H. Tyng,
Oswald W. Uhl,

Mrs. Walter M. Underhill,
Mrs. Henry C. Valentine,
James J. Van Alen,
Mrs. Frederick T. Van Beuren,
Augustus Van Cortlandt,
Barend Van Gerbig,
John B. Van Haelen,
E. H. Van Ingen,
Mrs. Warner M. Van Norden,
Edgar B. Van Winkle,
Mrs. Wilbur Linwood Varian,
Mrs. James M. Varnum,
Mrs. A. C. Veatch,
Thos. F. Vietor,
Alfonso P. Villa,
Ludwig Vogelstein,
Mrs. Owen M. Voight,
Dr. S. Wachsmann,
Harry Wacker,
Montgomery Waddell,
Mrs. J. Howard Wainwright,
Mrs. Gustavus A. Walker,
Mrs. W. K. Wallbridge,
Leo Wallerstein,
Dr. Max Wallerstein,
Wm. I. Walter,
Artemus Ward,
C. Blaine Warner,
Mrs. John I. Waterbury,
G. W. Watson,
Mrs. J. E. Watson,
Mrs. E. H. Weatherbee,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Dr. Eugene Wehmeyer,
Charles H. Weigle,
George A. Weigel,
Bernard Weinig,
Mrs. C. Gouveneur Weir,
George W. Weiss,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Oliver J. Wells,
Arthur L. Wessell,
Dr. William West,
Miss Edith Wetmore,
Dr. Wm. E. Wheelock,
Alfred T. White,
Miss Caroline White,
Clarence Whitman,
Miss Margaret S. Whitney,
Howard Whittemore,
F. B. Wiborg,
Miss F. E. Wickham,
Henry Wigglesworth,
William G. Willcox,
Elmore A. Willets,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
James R. Williston,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Dr. Margaret B. Wilson,
M. Orme Wilson,
Charles A. Wimpfheimer,
Harold Wingate,
Bronson Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Joseph Wittmann,
Lewis S. Wolff,
M. Wolff,
William E. Wolff,
Mrs. William H. Woodin,
Prof. R. S. Woodward,
Miss Julia Wray,
Mrs. J. Hood Wright,

Dr. Peter B. Wyckoff,
Dr. George A. Wyeth,
Mrs. A. Murray Young,
George A. Zabriskie,
Joseph A. Zanetti,
Henry C. Zaro,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
August Zinsser,
Charles Zoller,
Henry Zuckerman.

Members of the Women's Auxiliary

Mrs. George A. Armour,
Mrs. Robert Bacon,
Miss Elizabeth Billings,
Mrs. N. L. Britton,
Mrs. Charles D. Dickey,
Mrs. A. Barton Hepburn,
Mrs. Robert C. Hill,
Mrs. Wm. A. Hutcheson,
Mrs. Walter Jennings,
Mrs. Delancey Kane,
Mrs. Hamilton F. Kean,
Mrs. Gustav E. Kissel,
Mrs. A. A. Low,
Mrs. Charles Mac Veagh,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Mrs. George D. Pratt,
Mrs. Harold I. Pratt,
Mrs. James Roosevelt,
Mrs. Benson B. Sloan,
Mrs. Theron G. Strong,
Mrs. Henry O. Taylor,
Mrs. W. Gilman Thompson,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Mrs. James A. Scrymser,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

NEW YORK, January 10, 1921

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my Receipts and Disbursements during the year 1920, and Balance Sheet from my Ledger as of December 31, 1920.

Respectfully submitted,

JOHN L. MERRILL,
Treasurer.

RECEIPTS AND DISBURSEMENTS

Receipts

Balance, January 1, 1920		$ 16,011.34
Legacies		
Margaret Olivia Sage (on account of principal and interest, to be apportioned on final settlement of legacy)	$500,000.00	
Fanny Bridgham	30,000.00	
Mary J. Kingsland	5,000.00	
Louisa Combe	5,000.00	$540,000.00
Investment Account		
Science and Education Fund, redemption at maturity of		
$10,000 par value Bonds of Louisville and Nashville R. R. Co.	$ 10,000.00	
$10,000 par value Gt. Northern Ry. Co.	10,000.00	$ 20,000.00
John Innes Kane Fund, redemption at maturity of $10,000 par value Bonds of Gt. Northern Ry. Co.		$ 10,000.00

Temporary Investment, redemption at maturity of $13,000 par value U. S. Treasury Notes....	13,000.00	$ 43,000.00
General Income Account		
Income from General Investments		
4% on $59,000 Erie R. R. Penn. Coll. Trust Bonds..... ... ...$	2,360.00	
4% on $11,000 Milwaukee, Sparta & N. W. R. R. Bonds....	440.00	
4½% on $50,000 Ches. & Ohio R. R. Co. Genl. Mtge. Bonds..	2,250.00	
4% on $35,000 Nor. Pac. R. R. Bonds, Gt. Nor. C. B. & Q. Trust.	1,400.00	
4% on $50,000 Reading R. R. Co. Bonds, Jersey Centr. Coll. Tr..	2,000.00	
5% on $10,000 Gt. Nor. R. R. Bonds... ...	500.00	
4% on $10,000 New York City Stock, due 1959.....	400.00	
4% on $24,000 Nor. Pac. Bonds, 6 mos...	480.00	
5% on $10,000 Balto. & Ohio 4, 4 Bonds...	500.00	
4½% on $50,000 Penn. R. R. Genl. Mtge. Bonds...	2,250.00	
5% on $10,000 L. & N. R. R. Co. Notes, 6 mos....	250.00	
5% on $50,000 Southern Ry. 1st Consol. Mtge. Bonds..... ..	2,500.00	

4½% on $10,000 N. Y. Cent. Lines Eqpt. Bonds.....	450.00		
4% on $50,000 Erie R. R. Co. Prior Lien Bonds.....	2,000.00		
4¼% on $24,000 2nd Liberty Loan Bonds, 6 mos.....	510.00		
4¾% on $23,000 Victory Loan Bonds, 6 mos.....	546.24	$	18,836.25
Income from Temporary Investments, credited to General Income Account, interest on $13,000 U. S. Treasury Notes..			341.25
Income from Membership Dues, credited to General Income Account			
Fellowship Members.. $	200.00		
Sustaining Members..	300.00		
Annual Members.....	10,390.00	$	10,890.00
Sales of Merchandise, credited to General Income Account.....			134.75
Interest on Deposits, credited to General Income Account.....			1,787.58 $ 31,989.83
Special Income Accounts			
From Investment of John Innes Kane Fund			
4¾% on $10,000 U. S. Victory Bonds.....$	237.50		
5% on $10,000 Gt. Nor. Ry. Co. Bonds.....	500.00	$	737.50
From Investment of Maria DeWitt Jesup Fund			
4% on $15,000 Nor. Pac. Prior Lien Bonds.....	600.00		

4½% on $10,000 U. S. 3rd Liberty Loan Bonds.....	425.00	1,025.00
Income of the Addison Brown Fund		
4% on $22,000 Nor. Pac. Ry. Prior Lien Bonds.....	880.00	
Subscriptions to "Addisonia".....	2,586.52	3,466.52
From Investment of the Russell Sage and Margaret Olivia Sage Memorial Fund		
Dividends		
100 shares Amer. Tel. & Cable Co...	375.00	
400 shares Amer. Tel. & Tel. Co....	1,600.00	
250 shares U. S. Steel Pfd.....	1,312.50	
200 shares Manhattan Ry.....	700.00	
10 shares Importers & Traders Bank..	240.00	
52 shares Bankers Trust Co.....	780.00	
100 shares Balto. & Ohio R. R. Pfd.	200.00	
200 shares A. T. & SF. R. R. Co.....	500.00	
100 shares Un. Pac. Pfd.....	200.00	
Interest		
4% on $6,000 Manhattan Ry. Co. Bonds.....	87.33	
4¾% on $260,000 U. S. Victory Bonds, 6 mos.....	6,175.00	

4½% on $19,000 N. Y. Tel. Co. Bonds, 1st Mtge.	382.37		
4% on $10,000 Ore. Wash. R. R. Co. Bonds	245.56		
4% on $7,000 Centr. New Engl. Ry. 1st Gold Bonds	171.89		
3½% on $6,000 Balto. & Ohio R. R. Prior Lien Bonds	128.92		
4% on $17,000 Missouri Pac. R. R. Genl. 4's	190.78		
3½% on $7,000 Washn. Term. 1st Mtge. Bonds, 6 mos.	48.31		
4% on $6,000 Erie R. R. Prior Lien Bonds	147.33	$ 13,484.99	
Life Membership Fee, credited to Endowment Fund		$ 250.00	
Income of the David Lydig Fund, subscriptions to "North American Flora" and sales of publications		2,338.45	
Income of the William R. Sands Fund, contribution		5.48	
Income of the Stokes Fund, sales of leaflets		8.20	$ 21,316.14
Special Funds			
Charles Budd Robinson Memorial Fund, sale of book		$ .50	
Students' Research Fund, tuition fees		172.00	
Special Development Fund, contributions		13,485.00	

Plant Fund		
Contribution	$ 10.00	
Sale of hay	463.50	$ 473.50
Exploration Fund, refund		8.04
Convalescent Soldiers' Gardening Fund, tuition fees		5,727.70
Cherry Garden Shelter Fund, contribution		1,449.33
Louisa Combe Fund, interest	280.00	$ 21,596.07
Repayment by Employees of Liberty Bond Subscriptions		2,082.00
Contributions from New York City for Maintenance		143,762.63
		$819,758.01

Disbursements

Investment Accounts	
Russell Sage and Margaret Olivia Sage Memorial Fund,	
52 Shares Bankers Trust Co.	$ 19,500.00
200 Shares Manhattan Ry. Co.	9,125.00
250 Shares U. S. Steel Corp. Pfd.	27,359.37
10 Shares Importers & Traders National Bank	5,600.00
400 Shares Amer. Tel. & Tel. Co.	37,775.00
200 Shares A. T. & SF. Ry. Co. Pfd.	14,525.00
300 Shares Missouri Pac. R. R. Co. Common	7,068.75
200 Shares St. Louis SW. Ry. Co. Pfd.	4,450.00
100 Shares St. Louis SW. Ry. Co. Common	1,200.00

100 Shares M. K. & T. Ry. Pfd. (Equitable Trust Co. Ctfs.)	1,200.00
100 Shares Wabash Ry. Co. Common.....	800.00
100 Shares Wabash Ry. Pfd. "A".....	2,262.50
100 Shares Amer. Tel. & Cable Co.....	5,075.00
100 Shares Balto. & Ohio R. R. Co. Common.....	3,193.75
100 Shares Balto. & Ohio R. R. Co. Pfd.	4,400.00
100 Shares Un. Pac. R. R. Co. Pfd.....	6,237.50
$10,000 Ore. Washn. R. R. & Nav. 1st & Ref. 4%.....	6,500.00
$19,000 N. Y. Tel. Co. 1st & Genl. 4½%..	14,155.00
$17,000 Missouri Pac. R. R. Co. Gen. 4%.	8,755.00
$6,000 Erie R. R. Co. 1st Cons. Prior Lien 4%.....	3,015.00
$6,000 Balto. & Ohio R. R. Co. Prior Lien 3½%.....	4,860.00
$7,000 Centr. New Engl. Ry. 1st 4%...	3,675.00
$7,000 Washn. Term. Co. 3½%.....	4,830.00
$6,000 Manhattan Ry. Co. Cons. 4% "Stamped".....	3,120.00
	$198,681.87*

*Above stocks and bonds received from Executors' Estate of Margaret Olivia Sage.

$260,000 U. S. Govt.		
Victory Bonds.....	249,285.00	$447,966.87
Science & Education Fund		
$10,000 U. S. Govt.		
Victory Bonds.....$	9,626.50	
$13,000 U. S. Govt.		
Victory Bonds.....	12,514.45	22,140.95
John Innes Kane Fund		
$10,000 U. S. Govt.		
Victory Bonds..... $	9,626.50	
Temporary Investment		
$13,000 U. S. Govt. Treasury		
Notes.....	13,000.00	$492,734.32
Special Garden Accounts, Vouchers Paid		
Mary J. Kingsland Bequest..... $	1,300.80	
Special Book Fund.....	341.58	
Special Development Fund.....	7,224.30	
Plant Fund.....	214.39	
Exploration Fund.....	62.13	
Cherry Garden Shelter Fund.....	2,288.33	
Guggenheim Greenhouse Fund.....	1,651.20	
Grounds Improvement Fund.....	299.18	
Convalescent Soldiers Gardening Fund.....	7,450.90	
Museum and Herbarium Fund.....	66.00	
Reserve Fund.....	25,040.06	$45,938.87
Regular Garden Accounts		
Income of John Innes Kane Fund,		
Adjustment of Interest $ 192.66		
Vouchers Paid..... 567.83	$ 760.49	
Income of Russell Sage and Margaret Olivia Sage Memorial Fund,		
Adjustment of Interest 1,440.83		
Vouchers Paid..... 28,281.84	29,722.67	
Income of William R. Sands Fund,		
Vouchers Paid.....	599.50	

Income of D. O. Mills Fund,			
Vouchers Paid.....		2,432.93	
Income of Addison Brown Fund,			
Vouchers Paid.....		5,768.44	
Income of Maria DeWitt Jesup Fund,			
Vouchers Paid.....		1,010.98	
Income of Science & Education Fund,			
Vouchers Paid.....		4,366.74	
Income of David Lydig Fund,			
Vouchers Paid		10,001.19	
Income of General Fund,			
Interest to date of purchase on $13,000 U. S. Govt. Victory Bonds.....	250.39		
Interest to date of purchase on $10,000 U. S. Govt. Victory Bonds.....	192.66		
Adjustment of Interest	66.00		
Vouchers Paid.....$	25,663.89	$ 26,172.94	$ 80,835.88

Temporary Investment

Adjustment of interest on $13,000 U. S. Govt. Treasury Notes.....	$	41.14

City Maintenance Account

Vouchers Paid.....	143,762.63
Increased Appropriation to the Director-in-Chief for Working Fund.....	10,000.00
BALANCE, cash in hands of Treasurer December 31, 1920 (on deposit with J. P. Morgan & Co. and the New York Trust Company)	46,445.17
	$819,758.01

LEDGER BALANCES, December 31, 1920

Permanent Funds	*Debit*	*Credit*
Endowment Fund		$269,010.00
Science & Education Fund		83,461.90
Russell Sage and Margaret Olivia Sage Fund		500,000.00
David Lydig Fund		34,337.86
Fanny R. Bridgham Fund		30,000.00
William R. Sands Fund		10,000.00
Darius O. Mills Fund		50,000.00
Henry Iden Fund		10,000.00
Addison Brown Fund		21,850.00
John Innes Kane Fund		10,000.00
Stokes Fund		3,000.00
Charles Budd Robinson Memorial Fund		705.94
Students Research Fund		4,296.00
Maria DeWitt Jesup Fund		25,000.00
General Investments		
$50,000 Ches. & Ohio Genl. Mtge. Bonds		
$50,000 Southern Ry. Co. 1st Cons. Mtge. Bonds		
$50,000 Erie Ry. Co. Prior Lien Bonds		
$59,000 Erie Ry. Co. Penn. Coll. Tr. Bonds		
$24,000 U. S. Govt. 2nd Liberty Loan Bonds		
$50,000 Reading Ry. Co. Jers. Cent. Coll. Tr. Bonds		
$30,000 Nor. Pac. Gt. Nor. C. B. & Q. Coll. Bonds		
$10,000 New York City 4% Stock 1959		$312,424.18
Investment of Darius O. Mills Fund		
$50,000 Penn. Ry. Co. Genl. Mtge. Bonds	$ 50,500.00	

Investment of Science & Education Fund
$10,000 N. Y. Cent. Ry. Equip.
$10,000 Balto. & Ohio Rfd. Genl. Mtge. Bonds
$5,000 C. B. & Q. Joint 4's
$23,000 U. S. Govt. Victory Bonds . $ 46,595.18

Investment of Henry Iden Fund
$11,000 Milw. Sparta & N. W. 1st Mtge. Bonds..... 10,120.00

Investment of Addison Brown Fund
$22,000 Nor. Pac. Ry. Prior Lien Bonds..... 20,680.00

Investment of John Innes Kane Fund
$10,000 U. S. Govt. Victory Bonds . 9,626.50

Investment of Maria DeWitt Jesup Fund
$15,000 Nor. Pac. Ry. Prior Lien Bonds
$10,000 U. S. Govt. 3rd Liberty Loan Bonds..... 23,378.75

Investment of Russell Sage and Margaret Olivia Sage Memorial Fund, as per details under Disbursements..... 447,966.87

Profit and Loss Account..... 1,322.77

Income Accounts

Income of Jesup Fund.....	$	181.78
Income of Stokes Fund.....		254.24
Income of Students' Research Fund .		702.25
Income of John Innes Kane Fund ..		516.99
Income of Charles Budd Robinson Memorial Fund.....		70.67

Income of Lydig Fund			4,543.70
Income of Addison Brown Fund			175.81
Income of Russell Sage and Margaret Olivia Sage Memorial Fund			16,237.68
General Income			29,644.49
Temporary Funds			
Grounds Improvement Fund		$	58.98
Louisa Combe Bequest and accrued interest			5,385.60
Mary J. Kingsland Bequest			3,699.20
Special Book Fund			519.58
Special Development Fund			6,260.70
Plant Fund			492.04
Exploration Fund			19.96
Museum and Herbarium Fund			8.62
Convalescent Soldiers Gardening Fund			1,736.37
Reserve Fund	12,020.32		
Guggenheim Greenhouse Fund	187.37		
Income of temporary investments			300.11
Director-in-Chief, working fund	40,000.00		
Cash on deposit, December 31, 1920			
With J. P. Morgan & Co.	$ 38,916.86		
With New York Trust Company	7.528.31	46,445.17	
		1,071,868.79	1,071,868.79

Treasurer's Account for the Year 1920

Room 318, Grand Central Terminal
New York, May 19, 1921

Mr. Robert W. de Forest,
Chairman Finance Committee, New York Botanical Garden,
30 Broad Street, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and twenty (1920), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

The various investment securities have also been verified and accounted for, and I certify that the statement of the same reported in the balance sheet as of December 31, 1920, is correct.

Respectfully submitted,

A. W. Stone,
Special Auditor.

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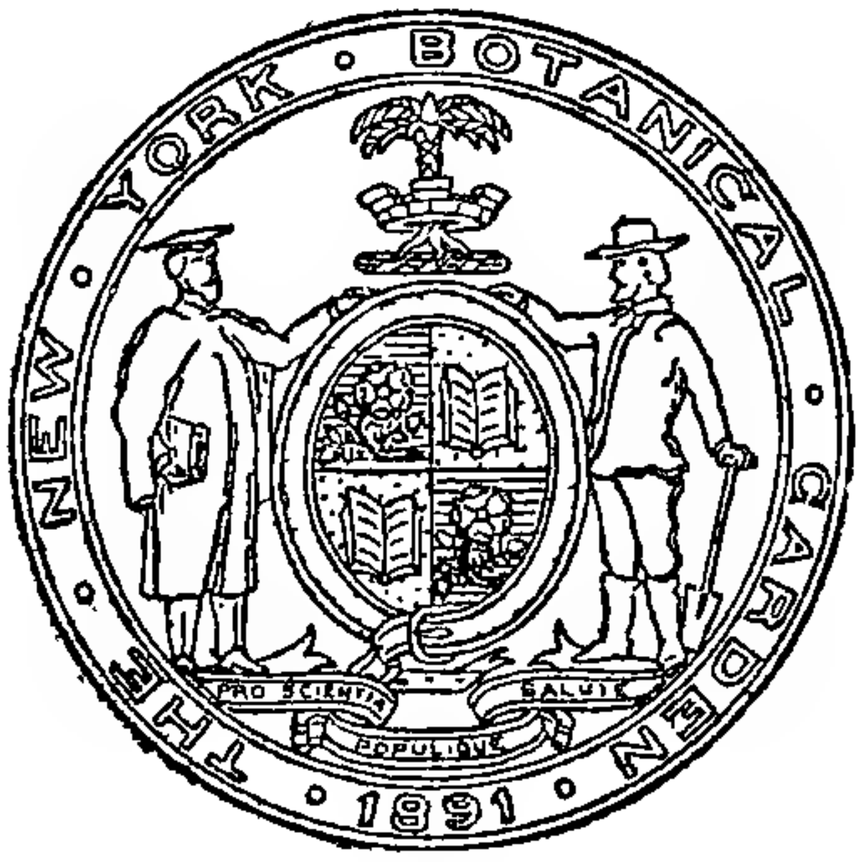

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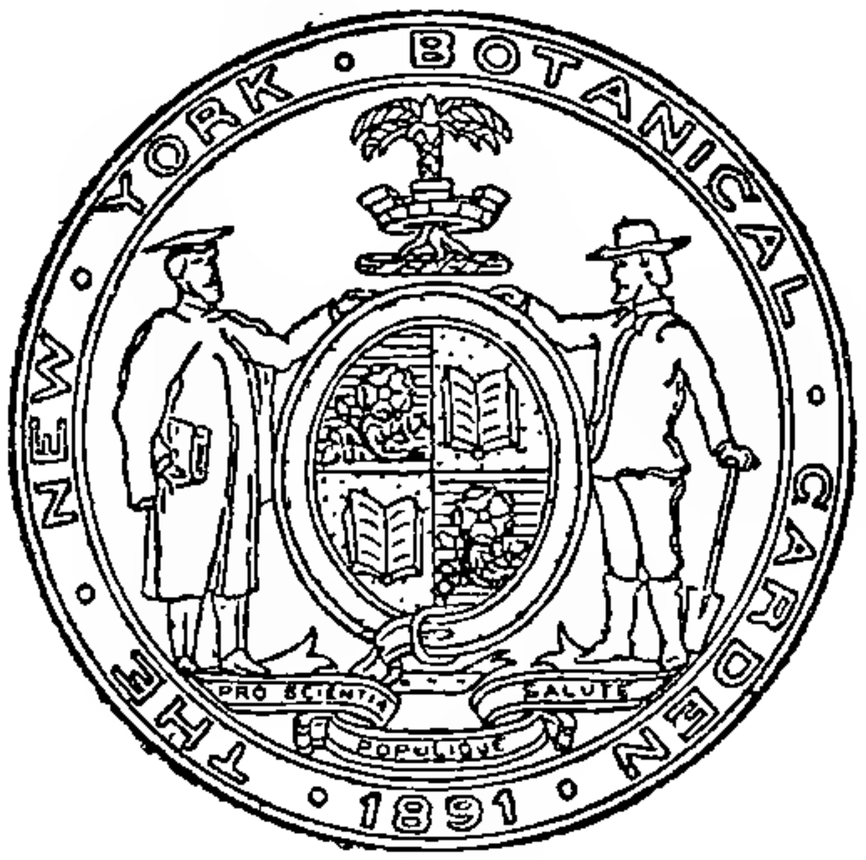

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